WISMO Quik Q25 series

WISMO Quik Q2501
Customer Design Guidelines

Reference : **WM_PRJ_Q2501_PTS_002**
Revision : **001**
Date : **March 2004**

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Document Information

Revision	Date	History of the evolution	
001	March 04	Preliminary version	

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Overview

The WISMO Quik Q2501 module is an E-GSM/DCS - GPRS 900/1800 MHz dual band module with 16 channels GPS receiver. It is dedicated to automotive applications, driven by AT commands.

The WISMO Quik Q2501 memory configuration is:

- GSM/GPRS part: 32 Mbits of Flash memory and 4 Mbits of SRAM,
- GPS part: 8 Mbits of Flash memory.

This document gives recommendations and general guidelines to design an application using the WISMO Quik Q2501 module.

It gives some recommendations for:

- Base Band design rules and typical implementation examples,
- RF design rules and typical implementation examples,
- Mechanical constraints for module fitting,
- PCB routing recommendations,
- Test and download recommendations.

Preliminary

It also recommends some manufacturers and suppliers for the peripheral devices which can be used with the WISMO Quik Q2501 modules.

For further information about the WISMO Quik Q2501 module, refer to the Product Technical Specification (document [2]).

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Contents

Document Information **2**

Overview **3**

Contents **4**

Table of figures **6**

Cautions **8**

Trademarks **8**

1 References **9**

1.1 Reference Documents 9

1.2 Glossary 9

1.3 Abbreviations 10

2 General Information **14**

2.1 Features 14

2.2 Functional architecture 16

3 Functional Design **17**

3.1 Power supply part 17
3.1.1 Main power supply and ground plane 17
3.1.2 RTC Back-up supply 20

3.2 Common GSM/GPS part 22
3.2.1 Module activation function (ON/~OFF) 22
3.2.2 Alternative download control function (BOOT) 22
3.2.3 Reset function (~RST) 23
3.2.4 Activity status indication function (FLASH_LED & GPS_TIMEPULSE) 24

3.3 GSM/GPRS Base Band part 25
3.3.1 GSM serial links 25
3.3.2 General purpose I/O 28
3.3.3 Peripheral buses 29
3.3.4 SIM interface 31
3.3.5 Keyboard interface 35
3.3.6 Audio interface 37
3.3.7 Buzzer interface 43
3.3.8 Digital Power Supply for External Devices (VCC) 44
3.3.9 GSM transmission activity status 44
3.3.10 GSM Base Band Activation indicator 45
3.3.11 External Interrupt 45
3.3.12 Auxiliary Analog Signals 46

3.4 GPS Base Band part 47
3.4.1 GPS activation function 47

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4.2 GPS serial links 48
3.4.3 Dead reckoning interface 50
3.4.4 1.8 V Digital Power Supply for External Devices 52
3.4.5 GPS External Interruption 52
3.4.6 GPS Antenna Power Supply 52
3.5 RF part 53
3.5.1 Antenna connection possibilities 53
3.5.2 GSM/GPRS antenna connection 54
3.5.3 GPS antenna connection 55
3.5.4 Single coax connection 59
4 PCB Design 60
4.1 General Rules and Constraints 60
4.2 Specific Routing Constraints 60
4.2.1 System Connector 60
4.2.2 Power Supply 60
4.2.3 SIM interface routing constraints 62
4.2.4 Audio circuit routing constraints 62
4.2.5 RF circuit routing constraints 63
4.3 Pads design 67
5 Mechanical Specifications 68
6 EMC and ESD recommendations 70
7 Firmware upgrade requirements 71
8 Embedded Testability 72
8.1 Access to the serial link 72
8.2 RF output accessibility for diagnostic 74
9 Manufacturers and suppliers 75
9.1 System connector 75
9.2 SIM Card Reader 75
9.3 Microphone 75
9.4 Speaker 76
9.5 RF cable 76
9.6 GSM antenna 76
9.7 GPS antenna 77
9.8 Buzzer 77
10 Appendix 78
10.1 80-pin PCB receptacle 79

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Table of figures

Figure 1: Functional architecture 16
Figure 2: Typical Power supply voltage in GSM/GPRS mode 18
Figure 3: RTC supplied by a super capacitor 20
Figure 4: RTC supplied by a non rechargeable battery 21
Figure 5: RTC supplied by a rechargeable battery cell 21
Figure 6: Example of ON/~OFF pin connection 22
Figure 7: Example of BOOT pin connection 22
Figure 8: Example of ~RST pin connection 23
Figure 9: Example N°1 of GSM and GPS activity status implementation 24
Figure 10: Example N°2 of GSM activity status implementation 24
Figure 11: Example of RS232 level shifter implementation for GSM UART1 25
Figure 12: Example of V24/CMOS serial link implementation for UART1 26
Figure 13: Example of RS232 level shifter implementation for GSM UART2 27
Figure 14: Example of SPI bus application 29
Figure 15: example of 2 wire bus application 30
Figure 16: Example of 3V SIM Socket implementation 31
Figure 17: Example of 1.8 V / 3 V SIM interface implementation 33
Figure 18: Example of 3 V / 5 V SIM interface implementation 34
Figure 19: Example of keyboard implementation 36
Figure 20: Example of main microphone (MIC2) implementation 38
Figure 21: MIC1 input differential connection 39
Figure 22: MIC1 input single ended connection 40
Figure 23: Speaker differential connection 41
Figure 24: Speaker single-ended connection 42

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Figure 25: Example of buzzer implementation 43

Figure 26: LED driven by the BUZ output 43

Figure 27: ~INTR driving example 45

Figure 28: Example of ADC application..... 46

Figure 29: GPS activation function implementation 47

Figure 30: Example of RS232 level shifter implementation for GPS UART2 48

Figure 31: Example of RS232 level shifter implementation for GPS UART0 49

Figure 32: SPI interface implementation for the dead reckoning function 50

Figure 33: Block diagram of the GPS antenna connection 55

Figure 34: GPS reception jammed by GSM/GPRS transmission 57

Figure 35: Example of Q2501 module and GPS antenna integrated application 58

Figure 36 :Example of power supply routing..... 60

Figure 37: Burst simulation circuit..... 61

Figure 38: AppCad Screenshot for MicroStrip design 63

Figure 39: Example of PCB routing for pigtail connection 66

Figure 40: Pads design..... 67

Figure 41: GSM UART1 serial link debug access 72

Figure 42: Module connection for RF measurements..... 74

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Cautions

Information furnished herein by Wavecom are accurate and reliable. However no responsibility is assumed for its use. Please read carefully the safety precautions for an application based on a WISMO Quik Q2501 module.

In addition, Wavecom reserves the right to modify this information with an aim of improving the accuracy of information provided herein.

General information about Wavecom and its range of products is available at the following internet address: http://www.wavecom.com

Trademarks

WAVECOM and WISMO are trademarks or registered trademarks of Wavecom S.A. All other company and/or product names mentioned may be trademarks or registered trademarks of their respective owners.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

1 References

1.1 Reference Documents

[1] Automotive Environmental Control Plan for WISMO Quik Q2501
WM_PRJ_Q2501_DCP_001

[2] WISMO Quik Q2501 Product Technical Specification
WM_PRJ_Q2501_PTS_001

[3] WISMO Quik Q2501 Process Customer Guidelines
WM_PRJ_Q2501_PTS_003

1.2 Glossary

Term	Definition
Performing a FIX	Means the GPS receiver is able to compute a position
Dead reckoning	GPS Feature that allows navigation with poor/no satellites view by the aid of external sensors that provide course (odometer) and heading (gyroscope).
Single Coax	WAVECOM concept that allows the user to use only one single coaxial cable for both GSM and GPS RF signal to connect the WISMO Quik Q2501 module to the antennas. The antennas are most of the time physically distinct but connected to the WISMO Quik Q2501 module by a single coaxial cable through an antenna switch system, saving a second coaxial cable.
Cold Start	Powering up a unit after it has been turned off for an extended period of time and no longer contains current ephemeris data. In Cold Start Scenario, the receiver has no knowledge on last position, approximate time or satellite constellation. The receiver starts to search for signals blindly. This is normal behavior, if no backup battery is connected. Cold Start time is the longest startup time for GPS receivers and can be several minutes.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Term	Definition
Hot Start	Start mode of the GPS receiver when current position, clock offset, approximate GPS time and current ephemeris data are all available. In Hot Start Scenario, the receiver was off for less than 2 hours. It uses its last Ephemeris data to calculate a position fix.
Warm Start	Start mode of a GPS receiver when current position, clock offset and approximate GPS time are known. Almanac data is retained, but the ephemeris data is cleared. In Warm Start Scenario, the receiver knows - due to a backup battery or by other techniques – his last position, approximate time and almanac. Thanks to this, it can quickly acquire satellites and get a position fix faster than in cold start mode.
Coarse Acquisition Code (C/A Code)	The standard positioning signal the GPS satellite transmits to the civilian user. It contains the information the GPS receiver uses to fix its position and time. Accurate to 24 meter. This code is a sequence of 1023 pseudorandom binary biphase modulations on the GPS carrier (L1) at a chipping rate of 1.023 MHz, thus having a code repetition period of 1 millisecond. The code was selected to provide good acquisition properties. Also known as the "civilian code.".

Preliminary

1.3 Abbreviations

Abbreviation	Definition
AC	Alternative Current
ADC	Analogue to Digital Converter
A/D	Analogue to Digital conversion
AF	Audio-Frequency
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
CAN	Controller Area Network
CB	Cell Broadcast
CEP	Circular Error Probable
CLK	CLocK

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Abbreviation	Definition
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
DAC	Digital to Analogue Converter
dB	Decibel
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DR	Dynamic Range
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMS	Enhanced Message Service
EN	ENable
ESD	ElectroStatic Discharges
FIFO	First In First Out
FR	Full Rate
FTA	Full Type Approval
GND	GrouND
GPI	General Purpose Input
GPIO	General Purpose Input Output
GPO	General Purpose Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
I/O	Input / Output
LED	Light Emitting Diode
LNA	Low Noise Amplifier

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Abbreviation	Definition
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
MMS	Multimedia Message Service
MO	Mobile Originated
MT	Mobile Terminated
NF	Noise Factor
NMEA	National Marine Electronics Association
NOM	NOMinal
PA	Power Amplifier
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control CHannel
PC	Personal Computer
PCB	Printed Circuit Board
PDA	Personal Digital Assistant
PFM	Power Frequency Modulation
PSM	Phase Shift Modulation
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RHCP	Right Hand Circular Polarization
RI	Ring Indicator
RST	ReSeT
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime services
RTS	Request To Send
RX	Receive
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level
SPK	SPeaKer
SRAM	Static RAM

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Abbreviation	Definition
TBC	To Be Confirmed
TDMA	Time Division Multiple Access
TP	Test Point
TVS	Transient Voltage Suppressor
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
USSD	Unstructured Supplementary Services Data
VSWR	Voltage Stationary Wave Ratio

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

2 General Information

2.1 Features

WISMO Quik Q2501 is self-contained E-GSM/DCS-GPRS 900/1800 dual-band module with 16 bits GPS receiver.

Following table reminds the WISMO Quik Q2501 features:

Feature	Information
Physical characteristics	Size: 58.4 x 32.2 x 6.3 mm. Weight: 11 g. Complete shielding.
Module control	Full set of AT commands for GSM/GPRS including GSM 07.07 and 07.05 AT command sets. Specific AT commands for GPS management on same link as GSM/GPRS AT commands. Direct reception of GPS data through serial link. Status indication for GSM and for GPS functions.
GSM/DCS	Frequency bands: • Rx (E-GSM 900): 925 to 960 MHz. • Rx (DCS 1800): 1805 to 1880 MHz. • Tx (E-GSM 900): 880 to 915 MHz. • Tx (DCS 1800): 1710 to 1785 MHz. Transmit power: • Class 4 (2 W) at E-GSM • Class 1 (1 W) at DCS
GPRS	GPRS multislot class 10. Multislot class 2 supported. PBCCH support. Coding schemes: CS1 to CS4.
Voice Features	GSM Voice Features with Emergency calls 112. Full Rate (FR)/ Enhanced Full Rate (EFR) / Half Rate (HR). Echo cancellation and noise reduction. Full duplex Hands free.
SMS	SMS MT, MO and SMS CB SMS storage into SIM card

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Feature	Information
GSM Supplementary Services	Call Forwarding, Call Barring. Multiparty. Call Waiting, Call Hold. USSD.
Data / Fax	Data circuit asynchronous, transparent, and non-transparent up to 14400 bits/s. Fax Group 3 compatible.
SIM interface	3 V only SIM interface. 1.8 & 5 V SIM interfaces are available with external adaptation. SIM Tool Kit Release 99.
GPS	GPS L1 civil frequency 1575.42 MHz. 16 channels GPS receiver. Accuracy: • 2.5 m CEP. • GPS 2 m CEP (depending on accuracy of correction data); SBAS/WAAS supported. Start-up times : • Hot start: < 3.5 sec. • Warm start: 33 sec. • Cold start: 34 sec. Signal reacquisition < 1 s. Protocols: • NMEA-0183 input/output. • UBX binary input/output. • RTCM in. Interface available for Dead Reckoning.
Real Time Clock	Real Time Clock with calendar and alarm. RTC update with GPS information.
Temperature sensor	Internal sensor for module temperature monitoring via AT commands or embedded OpenAT application.
Advanced antennas management	Single Coax connectivity. GPS active antenna management (3 V / 5 V compatible) with internal protection circuit. Possible use of an auto-powered GPS active antenna.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

2.2 Functional architecture

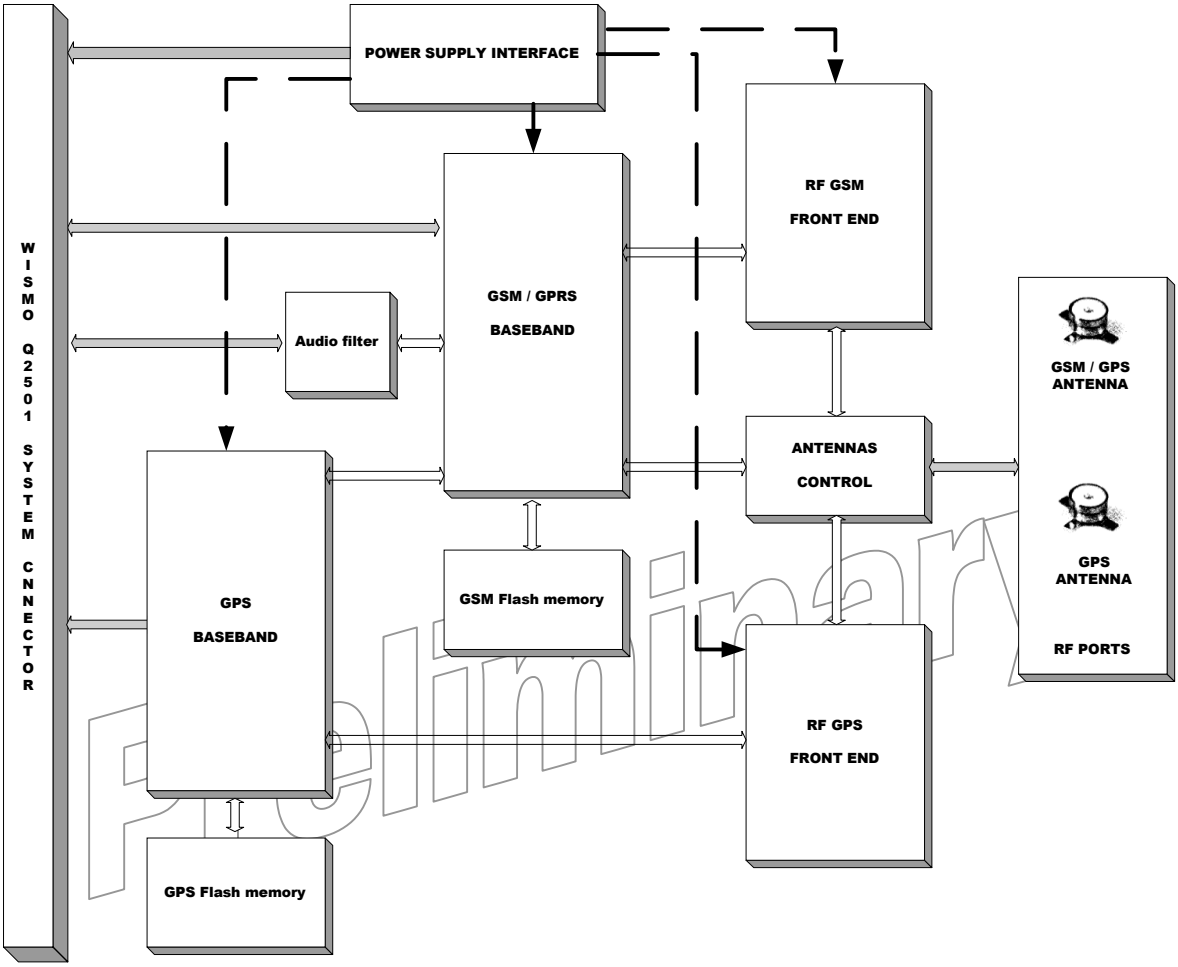


Figure 1: Functional architecture

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3 Functional Design

Some of the WISMO interface signals are multiplexed in order to limit the number of pins but this architecture implies some restrictions.

All external signals must be inactive when the WISMO module is OFF to avoid any damage when starting the module.

3.1 Power supply part

3.1.1 Main power supply and ground plane

3.1.1.1 Electrical constraints

The main power supply (VBATT) is the only external power supply source used to supply both the GSM/GPRS and GPS RF parts and Base Band parts.

The power supply is one of the key issues in the design of a GSM terminal. Due to the bursted emission in GSM / GPRS, the power supply must be able to deliver high current peaks in a short time (rising time is around 10 µs).

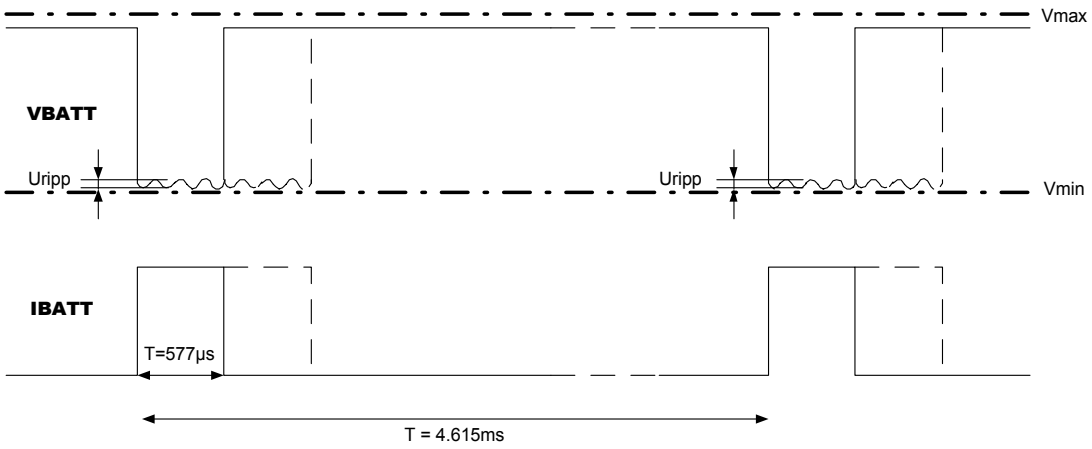
In communication mode, the GSM RF Power Amplifier current flows with a ratio of (Figure 2):

- Max current 1/8 of the time (around 577 µs every 4.615 ms for GSM/GPRS class 2 – 2RX / 1TX),
- Max current 2/8 of the time (around 1154 µs every 4.615 ms for GSM/GPRS class 10 – 3RX / 2TX).

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.



Legend:

——— In GSM or GPRS class 2 modes

— - In GPRS class 10 mode

Figure 2: Typical Power supply voltage in GSM/GPRS mode

During these peaks the ripple (U_{ripp}) on the supply voltage must not exceed a certain limit (refer to document [2]).

Because VBATT supplies directly the GSM RF power amplifier component, it is essential to keep a minimum voltage ripple at this connection in order to avoid any phase error or spectrum modulation degradation.

On the other hand, insufficient power supply voltage could dramatically affect some RF performances: TX power, modulation spectrum, EMC (Electro-Magnetic Compatibility) performances, spurious emission and frequency error.

The power supply voltage features given in the table hereunder will guarantee nominal functioning of the module.

Power Supply Voltage

	V_{MIN}	V_{NOM}	V_{MAX}	U_{ripp} max
VBATT	3.4 V (*)	3.6 V	4.5 V (**)	50 mVpp for freq<200 kHz 5 mVpp for freq>200 kHz

(*): This value has to be guaranteed during the burst (with 2.0 A Peak in GSM or GPRS mode).

(**): max operating Voltage Stationary Wave Ratio (VSWR) 2:1.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.1.1.2 Design requirements

A Careful attention should be paid to:

- Quality of the power supply:
  - linear regulation (recommended) or PWM (Pulse Width Modulation) converter (usable) are preferred for low noise.
  - PFM (Power Frequency modulation) or PSM (Phase Shift Modulation) systems must be avoided.
- Capacity to deliver high current peaks in a short time (bursted radio emission).
- The VBATT line must support peak currents with an acceptable voltage drop which guarantees a VBATT minimal value of 3.4 V (lower limit of VBATT).

For PCB design constraints related to power supply tracks, ground planes and shielding, refer to paragraph 4.2.2.

3.1.1.3 Decoupling of power supply signals

Decoupling capacitors on VBATT lines are imbedded in the module. So it should not be necessary to add decoupling capacitors close to the module.

However, in case of EMI/RFI problem, VBATT signal may require some EMI/RFI decoupling: parallel 33 pF capacitor close to the module or a serial ferrite bead (or both to get better results).

In case a ferrite bead is used, the recommendation given for the power supply connection must be carefully followed (high current capacity and low impedance).

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.1.2 RTC Back-up supply

3.1.2.1 Design requirements

VCC_RTC pin is used to provide a back-up power supply for the internal Real Time Clock (RTC).

The RTC is supported by the WISMO Quik Q2501 module when powered on, but a back-up power supply is needed to save date and time information when the module is switched off.

If the RTC is not used this pin can be left open.

Back-up Power Supply can be provided by:

- A super capacitor,
- A non rechargeable battery,
- A rechargeable battery cell.

3.1.2.2 Typical application electrical diagram

3.1.2.2.1 Super Capacitor

Preliminary

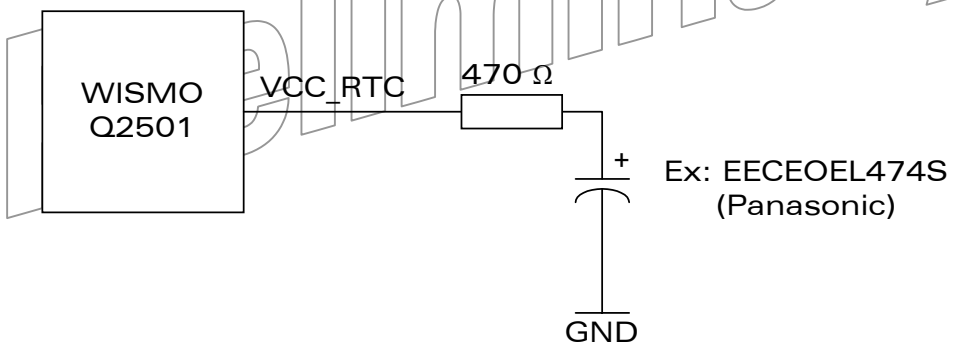


Figure 3: RTC supplied by a super capacitor

Estimated range with 0.47 Farad Gold Cap: 25 minutes min.

Note: the Gold Capacitor maximum voltage is 2.5 V.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.1.2.2.2 Non Rechargeable battery

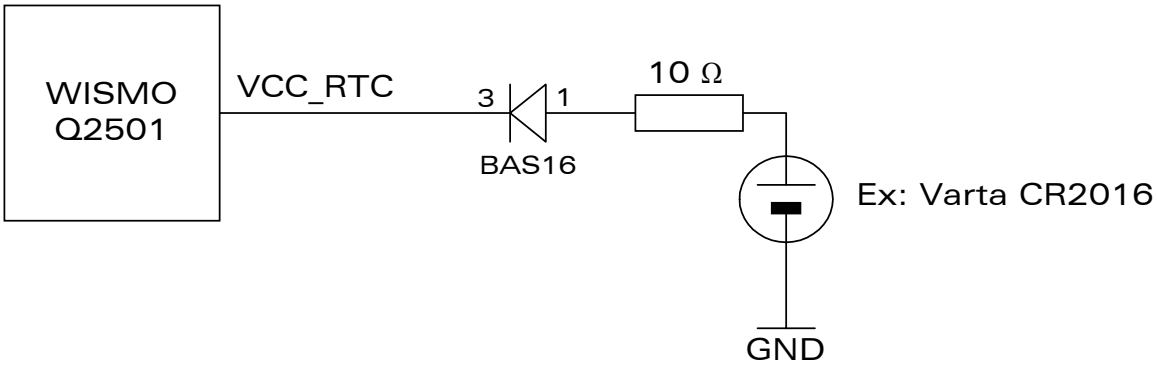


Figure 4: RTC supplied by a non rechargeable battery

Estimated range with 85 mAh battery: 800 h min.

3.1.2.2.3 Rechargeable battery cell

eliminary

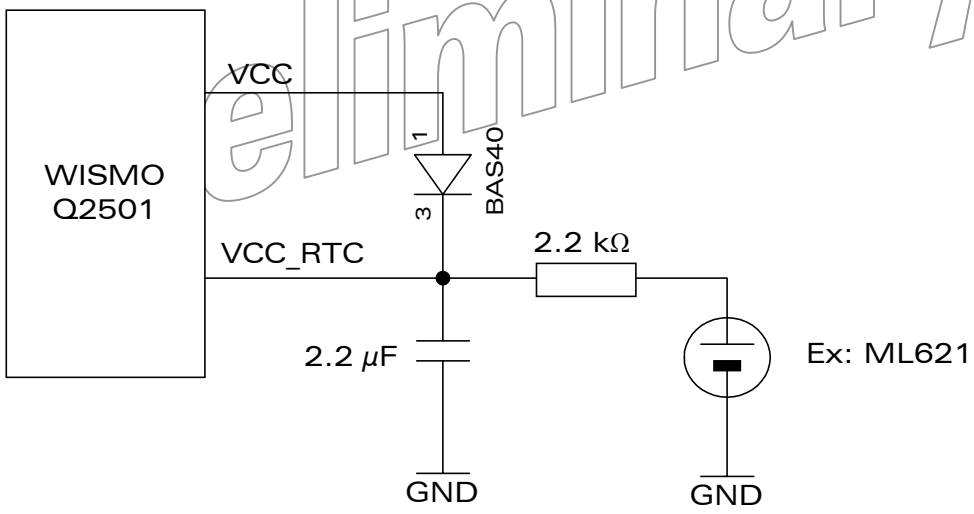


Figure 5: RTC supplied by a rechargeable battery cell

Estimated range with 2 mAh rechargeable battery: ~15 hours.

Warning:
Before battery cell assembly insure that cell voltage is lower than 2.75 V to avoid any damage to the WISMO module.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.2 Common GSM/GPS part

3.2.1 Module activation function (ON/~OFF)

The ON/~OFF input (pin 26) is used to switch ON (ON/~OFF=1) or OFF (ON/~OFF=0) the WISMO Quik Q2501 module.

A high level signal has to be provided on the pin ON/~OFF to swith ON the module.

The level of the voltage of this signal has to be maintained between 2.4 V and VBATT during a minimum of 500 ms.

This signal can be left at high level until switch OFF.

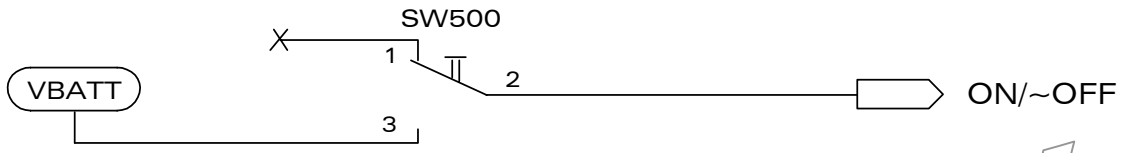


Figure 6: Example of ON/~OFF pin connection

3.2.2 Alternative download control function (BOOT)

If the standard X-modem download procedure does not work correctly, an alternative download procedure can be selected with the BOOT input (pin 32).

This alternative download procedure requires a specific downloading software tool.

The alternative download procedure is started when the BOOT pin is low during the reset of the module. A low level of BOOT input has to be set through a 1 kΩ resistor.

If used, this input has to be driven by an open collector or an open drain output as shown in the diagram hereunder:

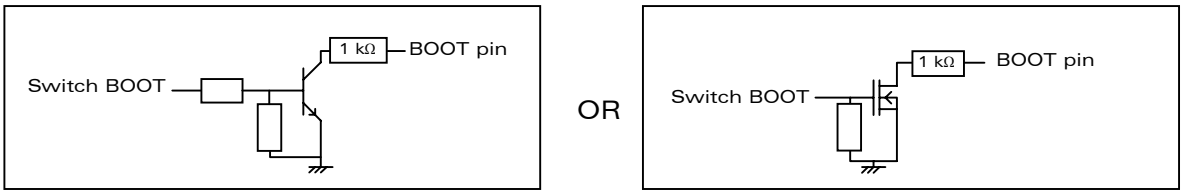


Figure 7: Example of BOOT pin connection

Switch BOOT	BOOT pin	Operating mode
1	0	Alternative download mode (use of BOOT input)
0	1	Normal download mode (use of X-modem protocol)

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.2.3 Reset function (~RST)

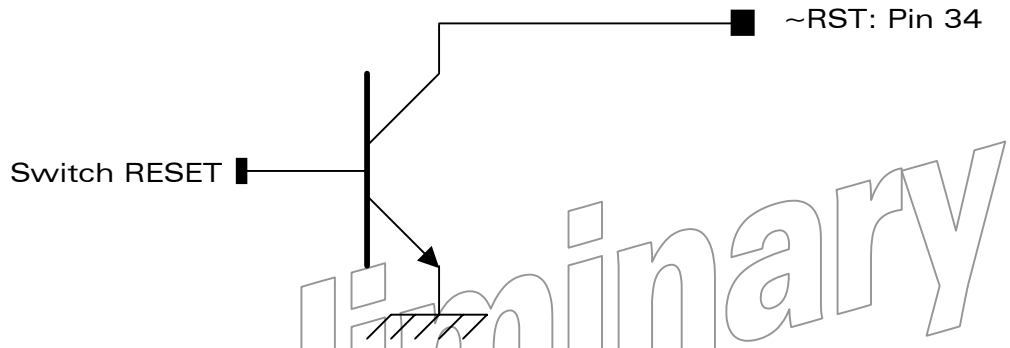
The ~RST input (pin 34) is used to force a reset procedure by providing low level during at least 500 µs.

This signal has to be considered as an emergency reset only: a reset procedure is automatically driven by an internal hardware during the power-up sequence.

This signal can also be used to provide a reset to an external device (it then behaves as an output).

If no external reset is necessary this input can be left open.

If used (emergency reset), it has to be driven by an open collector or an open drain output (due to the 4.7 kΩ internal pull-up resistor embedded into the module) as shown in the diagram hereunder.



Preliminary

Figure 8: Example of ~RST pin connection

Switch RESET	~RST pin	Operating mode
1	0	Reset activated
0	1	Reset inactive

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.2.4 Activity status indication function (FLASH_LED & GPS_TIMEPULSE)

The GSM and GPS activity status indication signals (FLASH_LED pin 72 and GPS_TIMEPULSE pin 17) can be used to drive two LEDs through an open-collector digital transistor according to the module activity status.

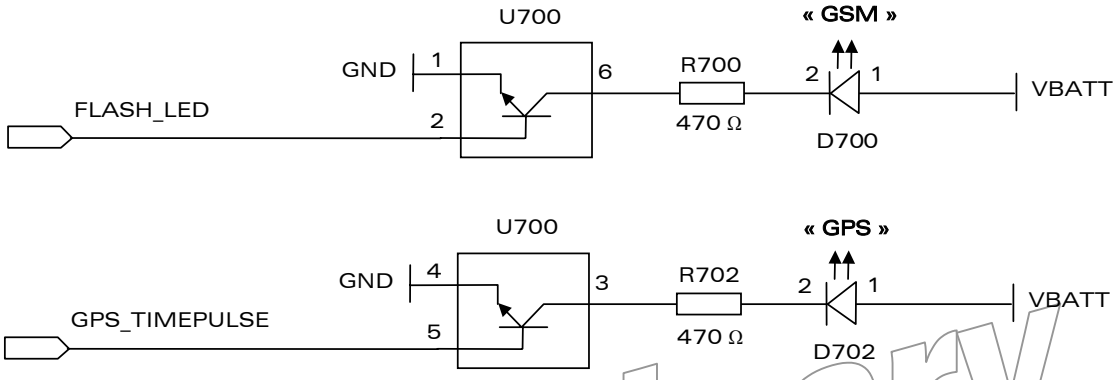


Figure 9: Example N°1 of GSM and GPS activity status implementation

Preliminary

In addition, given the electrical characteristics of the FLASH_LED output signal (CMOS 2.8 V), it is possible to directly connect a LED and a resistor between this output and VBATT to avoid adding a digital transistor inverter.

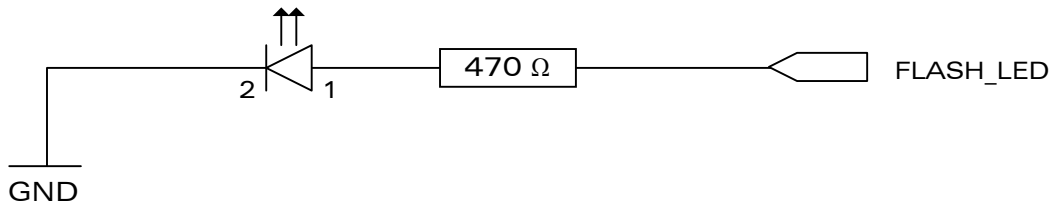


Figure 10: Example N°2 of GSM activity status implementation

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3 GSM/GPRS Base Band part

3.3.1 GSM serial links

The GSM/GPRS Base Band part of the WISMO Quik Q2501 includes two independent V24/CMOS serial link interfaces:

- UART1 (main serial link) which consists in a flexible 8-wire serial interface complying with V24 standard (TX, RX, CTS, RTS, DSR, DTR, DCD and RI),
- UART2 (auxiliary serial link) which consists in a flexible 4-wire serial interface complying with V24 standard (TX, RX, CTS and RTS).

Both serial link interfaces (UART1 and UART2) are compliant with V24 standard but not with V28 (electrical interface) due to a 2.8 Volt interface. To get a V24/V28 (i.e. RS232) interface, the use of an RS232 level shifter device is required as shown in the following paragraphs.

3.3.1.1 Main GSM Serial Link implementation (GSM_UART1)

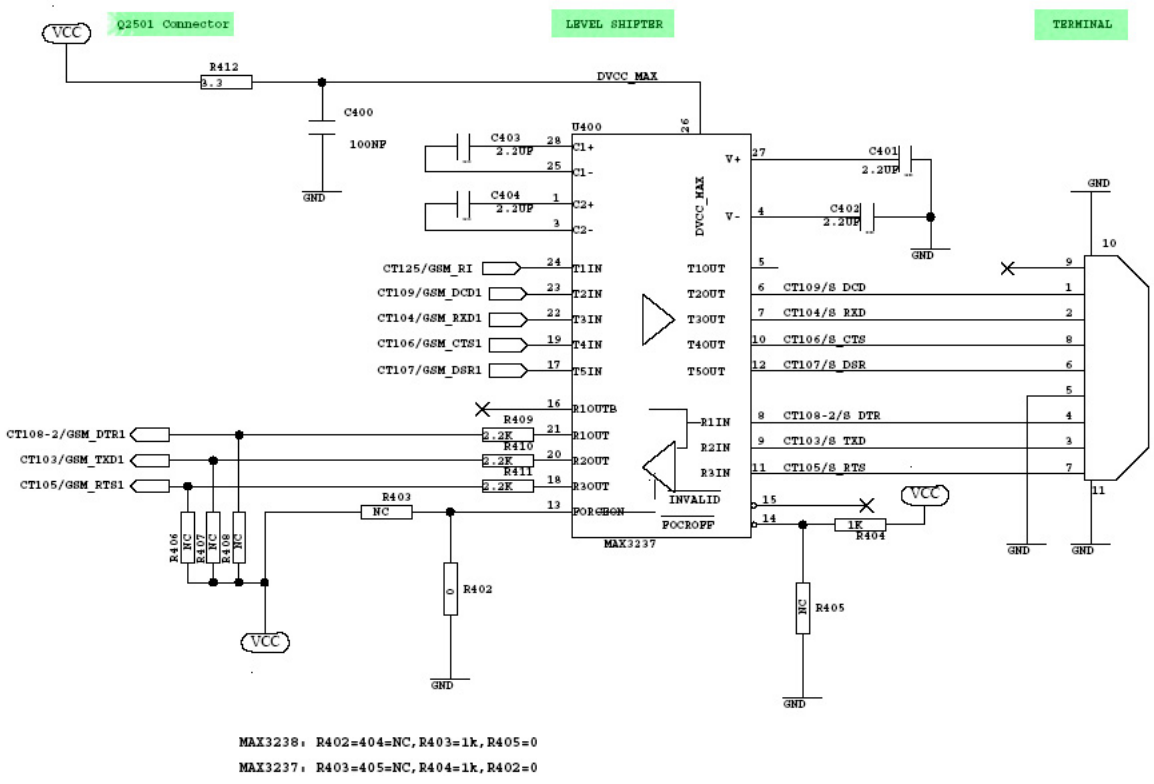


Figure 11: Example of RS232 level shifter implementation for GSM UART1

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

☞ Warning:

The application board must allow the WISMO serial link signals + the BOOT, the RESET and the ON/OFF module signals to be easily accessed thus allowing the module firmware to be upgraded.

V24/CMOS possible design:

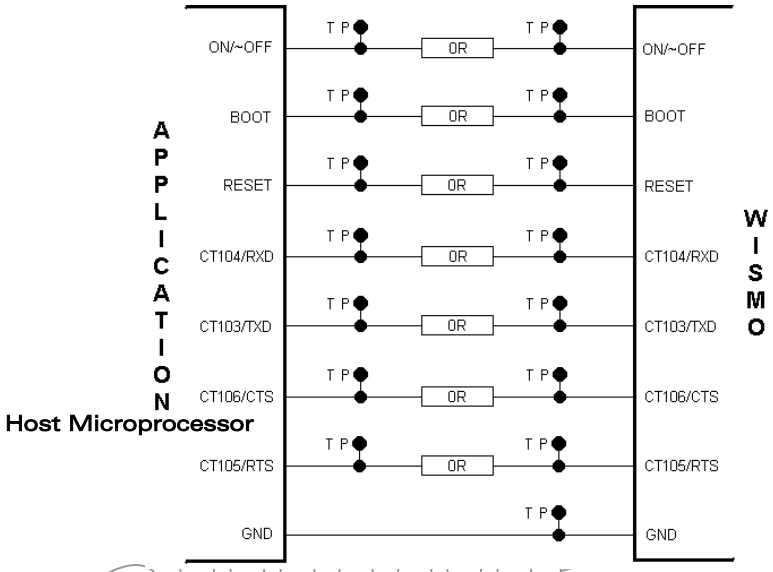


Figure 12: Example of V24/CMOS serial link implementation for UART1

The design given in the Figure above is a basic one. However, a more flexible design to access this serial link for testability and firmware downloading is given in paragraph 8.1.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.1.2 Auxiliary GSM Serial Link implementation (GSM_UART2)

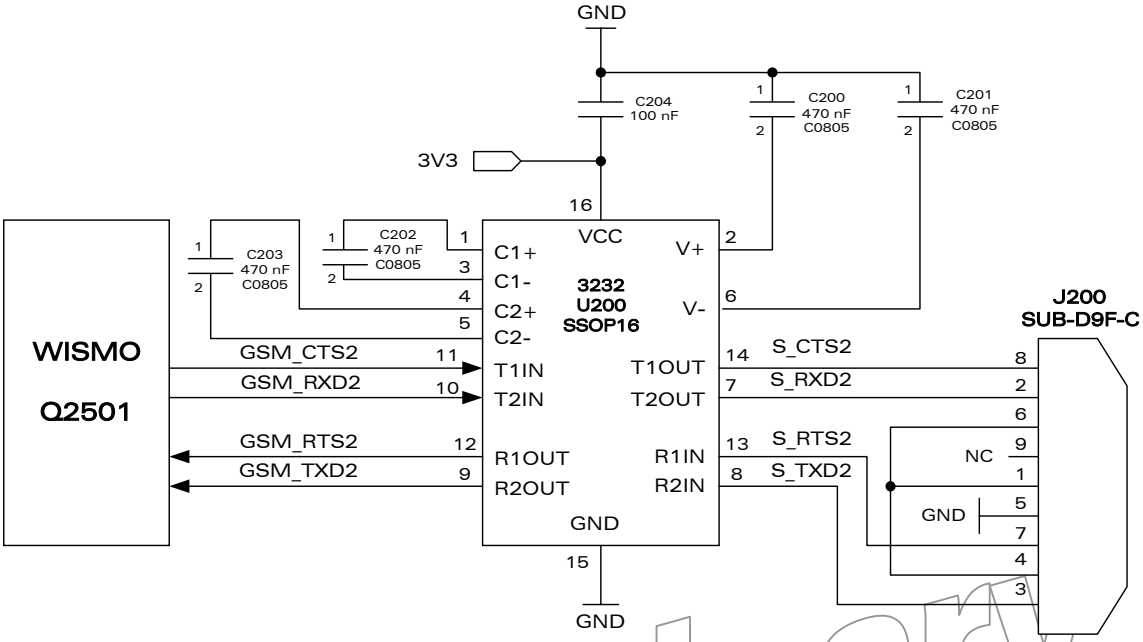


Figure 13: Example of RS232 level shifter implementation for GSM UART2

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.2 General purpose I/O

The WISMO Quik Q2501 provides:

- up to 6 GSM General Purpose I/O,
- up to 4 GSM General Purpose Output,
- up to 1 GSM General Purpose Input.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPIO0	44	I/O	CMOS3X	Multiplexed with GSM_CTS2
GPIO1	22	I/O	CMOS/2X	
GPIO2	24	I/O	CMOS/2X	
GPIO3	53	I/O	CMOS/2X	
GPIO4	73	I/O	CMOS/2X	
GPIO5	55	I/O	CMOS/3X	Multiplexed with GSM_RTS2
GPO0	46	O	3X	Multiplexed with SPI_AUX
GPO1	42	O	3X	Multiplexed with 1V8/3V or 3V/5V SIM card management signal
GPO2	40	O	3X	Multiplexed with GSM_RXD2
GPO3	48	O	3X	Multiplexed with SPI_EN
GPI	38	I	CMOS	Multiplexed with GSM_TXD2

Preliminary

For electrical characteristics of the GPIOs, refer to document [1].

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.3 Peripheral buses

One peripheral bus is available on the WISMO Quik Q2501 System Connector. It can be used to drive SPI peripherals (3-wire interface) or standard 2-wire peripherals.

The choice between these two types of peripherals is exclusive due to signal multiplexing.

3.3.3.1 SPI Bus

The SPI bus includes clock (SPI_CLK), I/O (SPI_IO) and enable signals (SPI_EN, SPI_AUX) complying with SPI bus standard. The maximum speed transfer is 3.25 Mb/s.

Pin description

Signal	Pin #	I/O	I/O type	Description
SDA/SPI_IO	28	I/O	CMOS/3X	SPI data signal
SCL/SPI_CLK	30	O	3X	SPI clock
SPI_EN	48	O	3X	Main SPI enable signal Multiplexed with GPO3
SPI_AUX	46	O	3X	Auxiliary SPI enable signal Multiplexed with GPO0

Preliminary

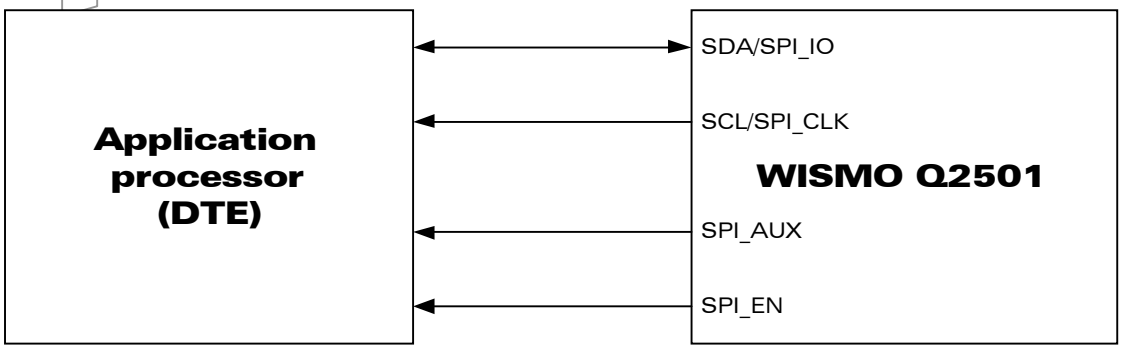


Figure 14: Example of SPI bus application

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.3.2 Two-wire bus

The 2-wire interface includes clock and data signals complying with a standard 96 kHz interface.

Each signal has to be pulled-up to VCC via an external 2.2 kΩ resistor.

The maximum speed transfer is 400 kbits/s.

Pin description

Signal	Pin #	I/O	I/O type	Description
SCL/SPI_CLK	30	O	3X	Serial Clock
SDA/SPI_IO	28	I/O	CMOS/3X	Serial Data

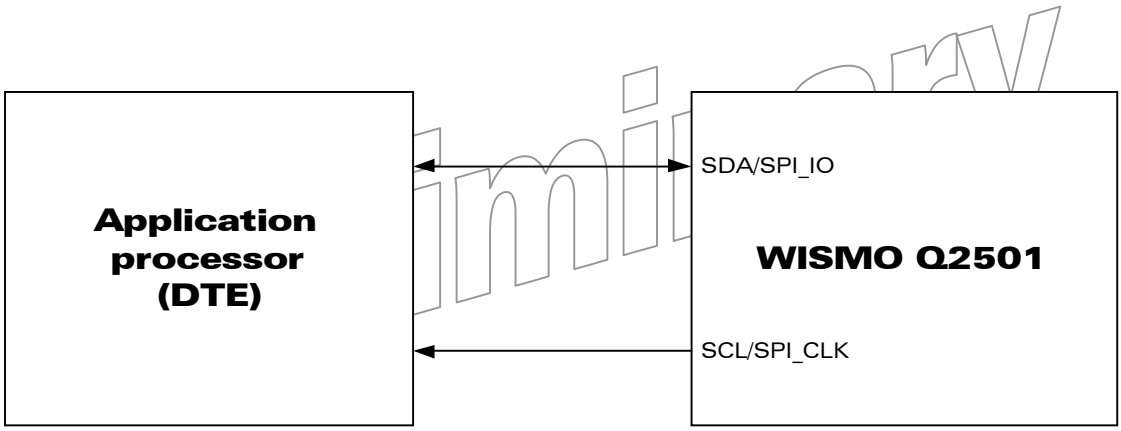


Figure 15: example of 2 wire bus application

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.4 SIM interface

3.3.4.1 SIM 3V management

The SIM interface controls a 3 V SIM card only.

To support 1.8 V/3 V or 3 V/5 V SIM cards, an external SIM driver (specific level shifter) is required (refer to paragraphs 3.3.4.2 and 3.3.4.3).

It is recommended to add Transient Voltage Suppressor diodes (TVS) on the signal connected to the SIM socket in order to prevent any ElectroStatic Discharge.

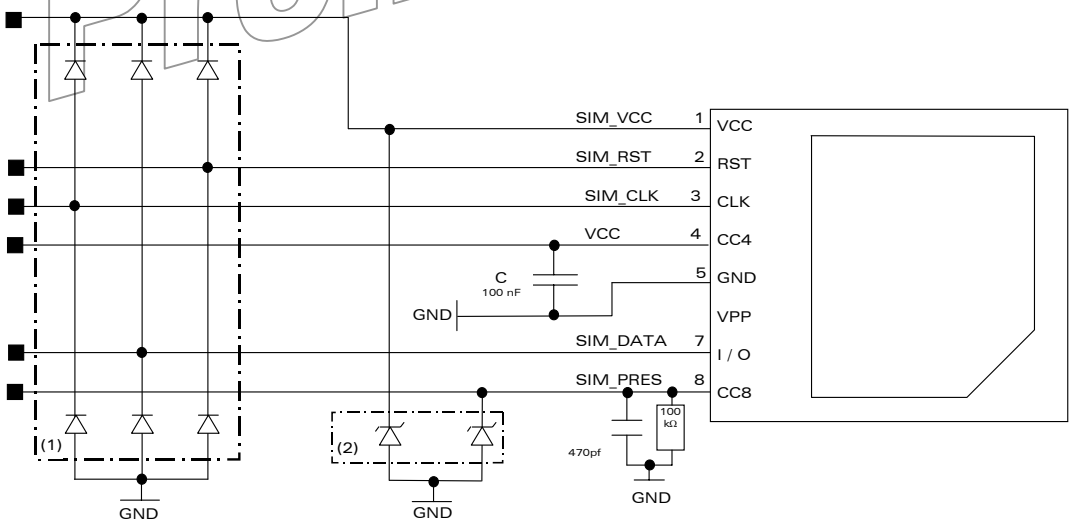
TVS diodes with low capacitance (less than 10 pF) have to be connected on SIM_CLK and SIM_DATA signals to avoid any disturbance of the rising and falling edge.

These types of diodes are mandatory for the Full Type Approval. They shall be placed as close as possible to the SIM socket.

The following references can be used: DALC208SC6 from ST Microelectronics.

Preliminary

Typical implementation with SIM detection:



(1) Recommended components: DALC208SC6 (SGS-THOMSON).

(2) Recommended components: ESDA6V1SC6 (ST).

Figure 16: Example of 3V SIM Socket implementation

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

SIM socket connection:

Pin description

Signal	Pin number	Description
VCC	1	SIM_VCC
RST	2	SIM_RST
CLK	3	SIM_CLK
CC4	4	VCC module
GND	5	GROUND
VPP	6	Not connected
I/O	7	SIM_DATA
CC8	8	SIM_PRES with 100 kΩ pull down resistor

The capacitor placed on the SIM_VCC line must not exceed 470 nF.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

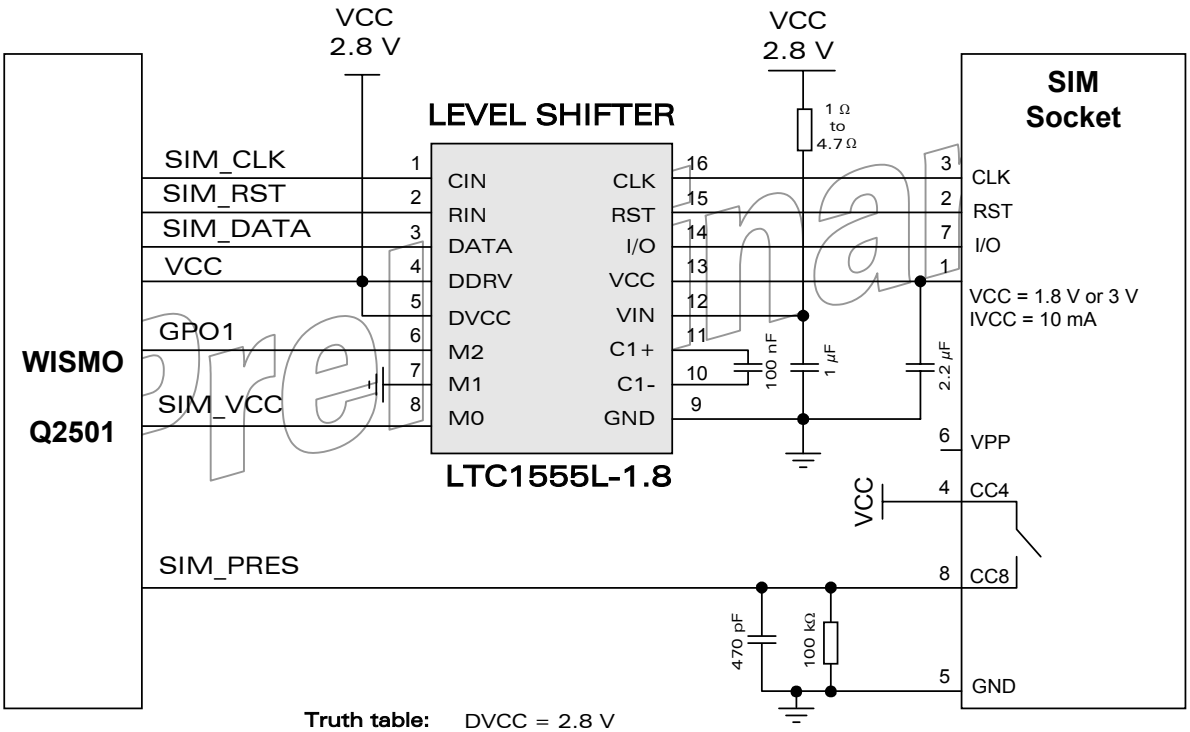
3.3.4.2 SIM 1.8 V / 3 V management

It is possible to manage 1.8 V and 3 V SIM cards using an external level shifter device (see Figure below).

In this case, depending on the type of SIM detected, the module firmware triggers the GPO1 output signal (pin #42) in order to properly set the external SIM driver level (1.8 V or 3 V).

As for 3 V SIM, it is recommended to add Transient Voltage Suppressors on the signals connected to the SIM socket (refer to Figure 16).

Typical implementation:



Truth table: DVCC = 2.8 V

M0	M1	M2	Operating Mode
0V	0V	0V or DVCC	Shutdown (VCC = 0V)
0V	DVCC	0V or DVCC	VCC = VIN
DVCC	0V	0V	VCC = 3 V
DVCC	0V	DVCC	VCC = 1.8 V
DVCC	DVCC	0V or DVCC	VCC = 5 V

Figure 17: Example of 1.8 V / 3 V SIM interface implementation

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

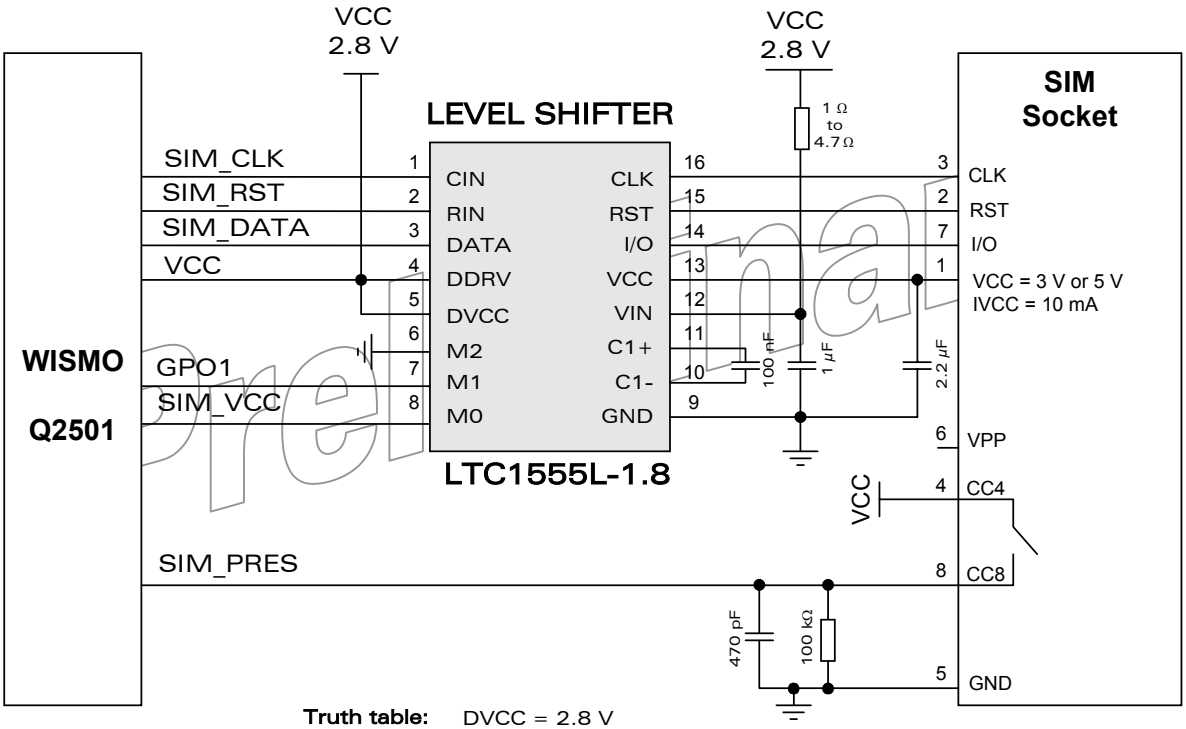
3.3.4.3 SIM 3 V / 5 V management

It is possible to manage 3 V and 5 V SIM cards using an external level shifter device (see Figure below).

In this case, depending on the type of SIM detected, the module firmware triggers the GPO1 output signal (pin #42) in order to properly set the external SIM driver level (3 V or 5 V).

As for 3 V SIM, it is recommended to add Transient Voltage Suppressors on the signals connected to the SIM socket (refer to Figure 16).

Typical implementation:



Truth table: DVCC = 2.8 V

M0	M1	M2	Operating Mode
0V	0V	0V or DVCC	Shutdown (VCC = 0V)
0V	DVCC	0V or DVCC	VCC = VIN
DVCC	0V	0V	VCC = 3 V
DVCC	0V	DVCC	VCC = 1.8 V
DVCC	DVCC	0V or DVCC	VCC = 5 V

Figure 18: Example of 3 V / 5 V SIM interface implementation

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.5 Keyboard interface

This interface provides 10 connections:

- 5 rows (ROW0 to ROW4),
- 5 columns (COL0 to COL4).

The scanning is a digital one, and the debouncing is done in the WISMO module. No discrete components like resistors or capacitors are needed.

The keyboard scanner is equipped with internal pull-down resistors for the rows and pull-up resistors for the columns. Current only flows from the column pins to the row pins. This allows a transistor to be used in place of the switch for power-on functions.

Pin description

Signal	Pin #	I/O	I/O type	Description
ROW0	33	I/O	CMOS / 1X	Row scan
ROW1	35	I/O	CMOS / 1X	Row scan
ROW2	37	I/O	CMOS / 1X	Row scan
ROW3	39	I/O	CMOS / 1X	Row scan
ROW4	41	I/O	CMOS / 1X	Row scan
COL0	43	I/O	CMOS / 1X	Column scan
COL1	45	I/O	CMOS / 1X	Column scan
COL2	47	I/O	CMOS / 1X	Column scan
COL3	49	I/O	CMOS / 1X	Column scan
COL4	51	I/O	CMOS / 1X	Column scan

Preliminary

Electrical characteristics

Parameter	Input type	Output type	Min	Max	Condition
V_{IL}	CMOS		-0.5 V	0.8 V	
V_{IH}	CMOS		2.1 V	3.0 V	
V_{OL}		1X		0.2 V	I_{OL} = -1 mA
V_{OH}		1X	2.6 V		I_{OH} = 1 mA

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

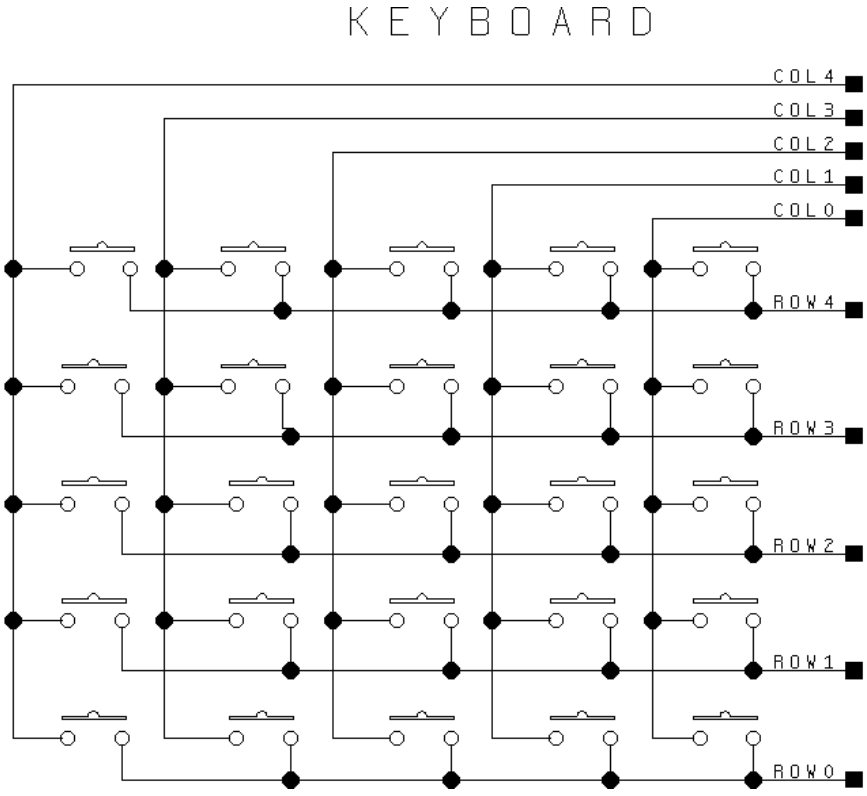


Figure 19: Example of keyboard implementation

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6 Audio interface

3.3.6.1 General

Two different microphone inputs and two different speaker outputs are supported.

The WISMO Quik Q2501 also includes echo cancellation and noise reduction features improving quality of hands-free function.

In some cases, ESD protection must be added on the audio interface lines.

3.3.6.2 Microphone inputs

3.3.6.2.1 General description

The difference between main microphone inputs (MIC2) and auxiliary microphone inputs (MIC1) is the availability of an internal biasing for an electret microphone.

For both microphone paths the connection can be either differential or single-ended but using a differential connection in order to reject common mode noise and TDMA noise is strongly recommended.

Preliminary

When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

3.3.6.2.2 Main Microphone Inputs (MIC2)

MIC2 inputs include an internal convenient biasing for an electret microphone. This electret microphone can be directly connected on these inputs, either in differential or single-ended mode.

AC coupling is already embedded in the module.

Pin description

Signal	Pin #	I/O	I/O type	Description
MIC2P	66	I	Analog	Microphone 2 positive input
MIC2N	68	I	Analog	Microphone 2 negative input

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6.2.3 Main Microphone input typical implementation

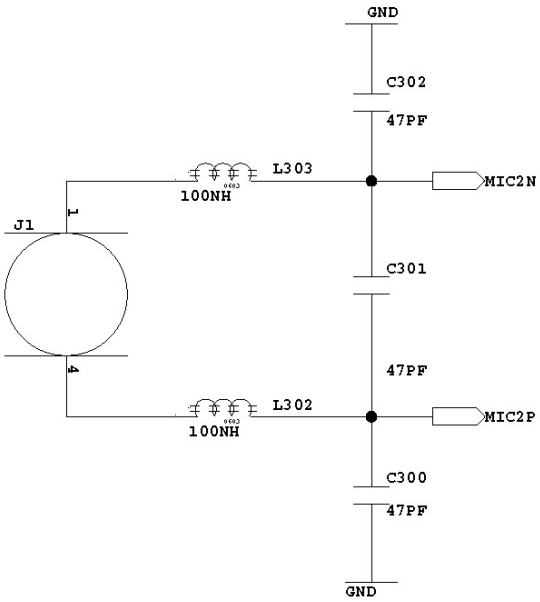


Figure 20: Example of main microphone (MIC2) implementation

Preliminary

3.3.6.2.4 Auxiliary Microphone Inputs (MIC1)

MIC1 inputs do not include internal bias, making these inputs the standard ones for an external headset or a hands-free kit, connected either in differential or single-ended mode.

To use these inputs with an electret microphone, bias has to be generated outside the WISMO Quik Q2501 module according to the characteristics of this electret microphone.

AC coupling is already embedded in the module.

Pin description

Signal	Pin #	I/O	I/O type	Description
MIC1P	62	I	Analog	Microphone 1 positive input
MIC1N	64	I	Analog	Microphone 1 negative input

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6.2.5 Differential connection example

Impedance of the microphone input in differential mode:

- Module ON: Rin = 10 kΩ ± 30 %,
- Module OFF: Rin > 10 MΩ ± 30 %.

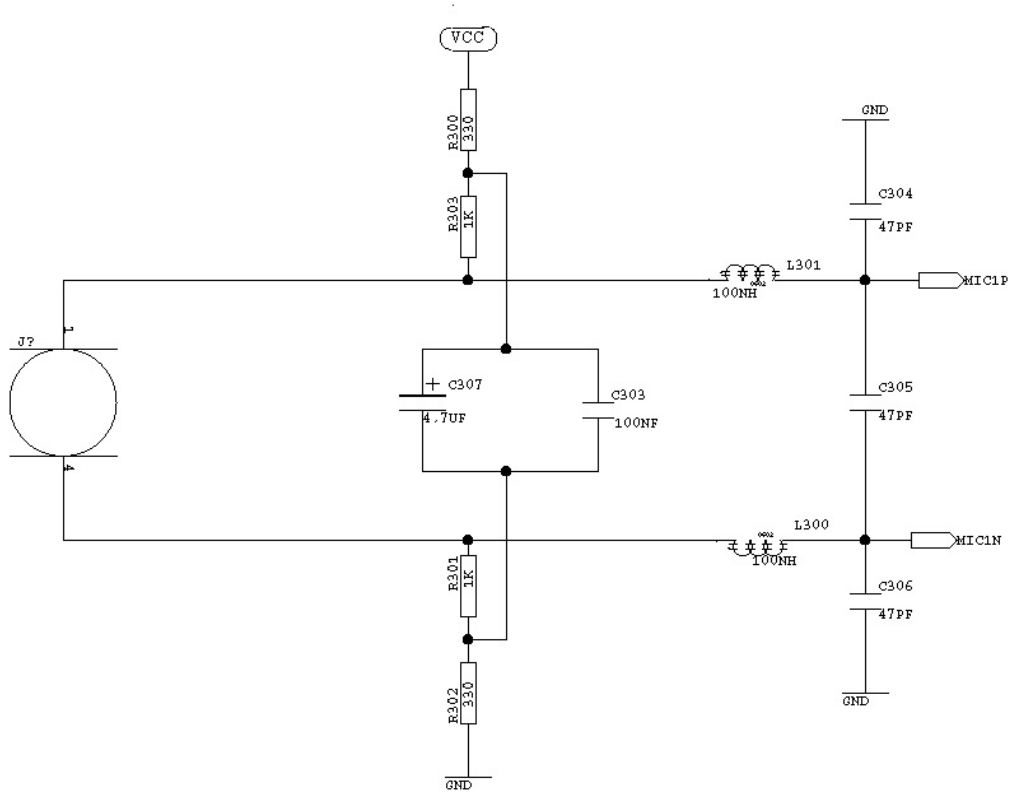


Figure 21: MIC1 input differential connection

L300, L301, C304, C305, C306 should be placed as close as possible to the pin #62 (MIC1P) and pin #64 (MIC1N) of the WISMO Q2501 module system connector.

It is better using another 2.8 V power supply instead of VCC (system connector pin #60) due to TDMA noise.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6.2.6 Single ended connection example

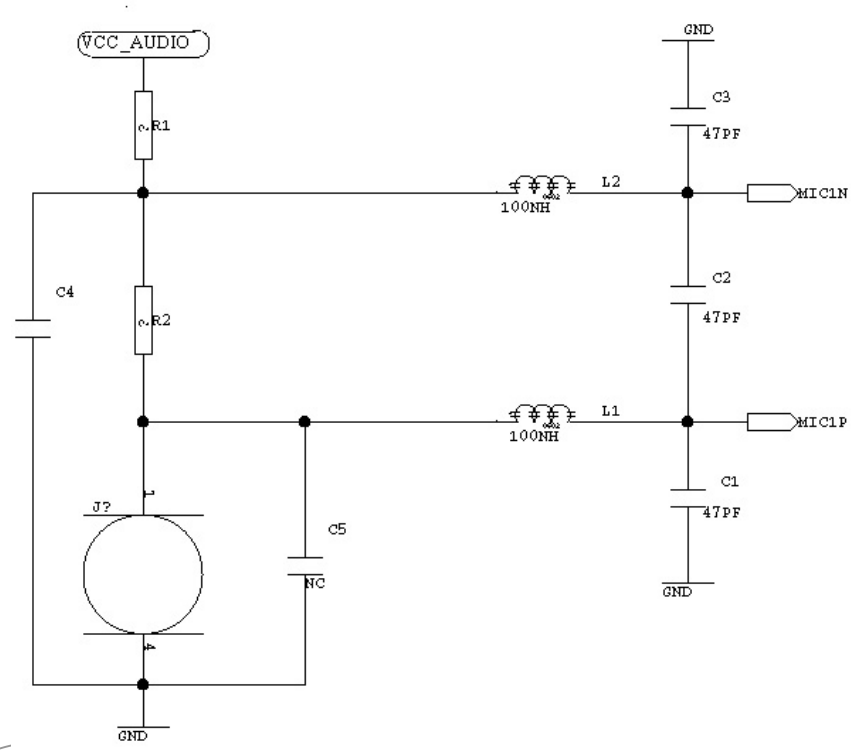


Figure 22: MIC1 input single ended connection

VCC_AUDIO must be very "clean" to avoid bad performance in case of single-ended implementation. That is the reason why VCC_AUDIO must be an other 2.8 V to 3 V power supply instead of VCC which is available on system connector (pin #60).

R1 is used as a voltage supply filter with C4.

R1, R2, C4 and C5 have to be placed as close as possible to the microphone (PCB tracks from the module connector to these components must be as straight and parallel as possible).

C1, C2, C3 have to be placed very close to the module connector.

L1 and L2 have to be placed close to the module connector and they can be removed according to their environment (ground plane, shielding...etc). The best way is to plan all the components and to remove those which are not necessary to filter out the TDMA noise on the audio path.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6.3 Speaker outputs

These outputs are differential and the output power can be adjusted by step of 2 dB. Speaker outputs can be directly connected to a speaker.

The gain of the speaker outputs is internally adjusted and can be tuned using an AT command (refer to AT commands documentation).

Pin description

Signal	Pin #	I/O	I/O type	Description
SPK2P	65	O	Analog	Speaker 2 positive output
SPK2N	67	O	Analog	Speaker 2 negative output

Pin description

Signal	Pin #	I/O	I/O type	Description
SPK1P	61	O	Analog	Speaker 1 positive output
SPK1N	63	O	Analog	Speaker 1 negative output

Preliminary

3.3.6.3.1 Common speaker output characteristics

The connection can be either differential or single-ended but using a differential connection to reject common mode noise and TDMA noise is strongly recommended. When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

3.3.6.3.2 Differential connection

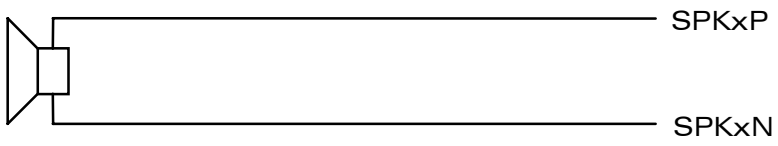


Figure 23: Speaker differential connection

Impedance of the speaker amplifier output in differential mode:

$R \leq 1\Omega$ +/-10 %.

The connection between the module pins and the speaker must be designed to keep the serial impedance lower than 3 Ω in differential mode.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.6.3.3 Single-ended connection

Typical implementation:

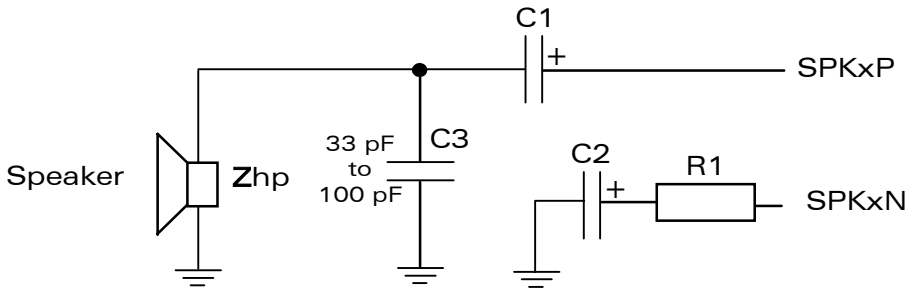


Figure 24: Speaker single-ended connection

4.7 µF < C1 < 47 µF (depending on speaker characteristics and output power).

C1 = C2.

R1 = Zhp.

Using a single-ended connection includes losing of the output power (- 6 dB) compared to a differential connection.

Nevertheless in a 32-Ohm speaker case, you should use a cheaper and smaller solution: R1 = 82 Ohms and C2 = 4.7 µF (ceramic).

The connection between the module pins and the speaker must be designed to keep the serial impedance lower than 1.5 Ω in differential mode.

Preliminary

3.3.6.3.4 Recommended characteristics for the speaker

- Type: 10 mW, electro-magnetic.
- Impedance:
  - Z = 8 Ω for handset,
  - Z = 32 Ω for headset or hands-free kit.
- Sensitivity: 110 dB SPL min. (0 dB = 20 µPa).
- Frequency response compatible with the GSM specifications.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.7 Buzzer interface

The buzzer output (BUZ) is a digital one. A buzzer can be directly connected between this output and VBATT.

Pin description

Signal	Pin #	I/O	I/O type	Description
BUZ	69	O	Open collector	Buzzer output

The maximum peak current is 80 mA and the maximum average current is 40 mA. A diode against transient peak voltage must be added as described below.

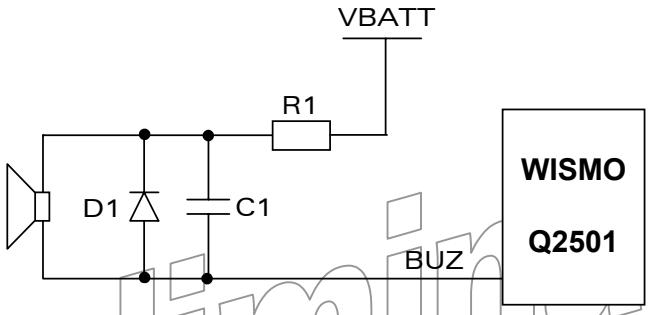


Figure 25: Example of buzzer implementation

Preliminary

R1 must be chosen in order to limit the current at I_{PEAK} max.

C1 = 0 to 100 nF (depending on the buzzer type).

Recommended characteristics for the buzzer:

- Type: electro-magnetic.
- Impedance: 7 to 30 Ω.
- Sensitivity: 90 dB SPL min @ 10 cm.
- Current: 60 to 90 mA.

The BUZ output can also be used to drive a LED as shown in the Figure Below:

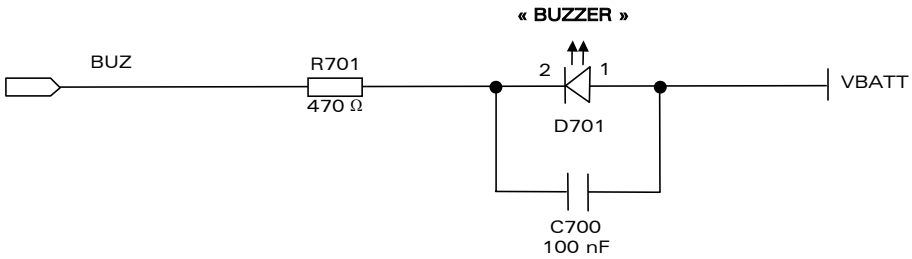


Figure 26: LED driven by the BUZ output

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.8 Digital Power Supply for External Devices (VCC)

This output can be used to power some external functions. VCC has to be used as a 2.8 V digital power supply. This power supply is available when the module is on.

Pin description

Signal	Pin #	I/O	I/O type	Description
VCC	60	O	Supply	2.8 V Power supply for external digital devices

VCC digital power supply is mainly used to:

- pull-up signals such as I/O,
- supply the digital transistors driving LEDs,
- supply the SIM_PRES signal,
- act as a voltage reference for ADC interface (AUXADC),
- etc.

The maximal current being able to be provided by VCC output is 10 mA.

Preliminary

3.3.9 GSM transmission activity status

WISMO Quik Q2501 provides a status indication about the GSM RF transmission activity (GSM_PAC_EN).

This output can be used for example as a power supply synchronization in order to guarantee a correct current supply during transmission bursts.

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_PAC_EN	20	O	Digital	GSM transmission activity status

This signal indicates the following status:

- GSM_PAC_EN=0: no operation,
- GSM_PAC_EN=1: indicates increased power consumption during transmission.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.10 GSM Base Band Activation indicator

The GSM Base Band activation indicator (GSM_BBEN) is available on system connector.

This output signal is driven and supplied by RTC part and can be used as an external information allowing the main power supply (VBATT) to be externally switched OFF.

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_BBEN	6	O	CMOS VCC_RTC / 1X	Indicator of GSM Base Band activation

3.3.11 External Interrupt

The WISMO module provides an external interrupt input (~INTR).

This input can be used for instance to automatically power off the module by an external event.

Pin description

Signal	Pin #	I/O	I/O type	Description
~INTR	36	I	CMOS	External Interrupt

Preliminary

An interrupt is activated on high to low edge and detection of a transition is very sensitive.

If this signal is not used it can be left open.

If used this input has to be driven by an open collector or an open drain output as shown in the diagram hereunder.

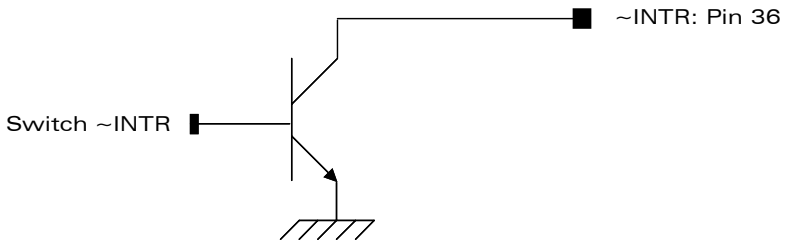


Figure 27: ~INTR driving example

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.3.12 Auxiliary Analog Signals

3.3.12.1 Analog To Digital Converter Input

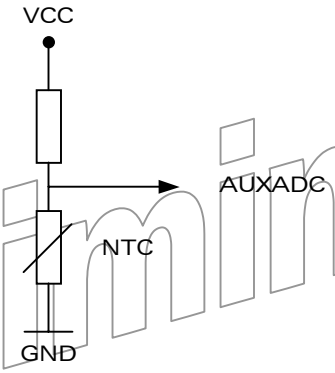
WISMO Quik Q2501 provides an analog to digital converter.

It is a 10 bit resolution ADC ranging from 0 V to 2.8 V.

AUXADC input can be used, for example, to monitor external temperature, useful for safety power off in case of application over heating.

Pin description

Signal	Pin #	I/O	I/O type	Description
AUXADC	58	I	Analog	A/D converter



Preliminary

Figure 28: Example of ADC application

3.3.12.2 Digital To Analog Converter output

WISMO Quik Q2501 provides a Digital to Analog Converter output.

Pin description

Signal	Pin #	I/O	I/O type	Description
AUXDAC	31	O	Analog	D/A converter

This converter is a 8-bit resolution, ranging from 0.15 V to 2.64 V.

AUXDAC output can be used as a programmable voltage generator.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4 GPS Base Band part

3.4.1 GPS activation function

The GPS function can be activated either by software or by hardware command.

Hardware control of the GPS activation function is defined by the software.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_EN	21	I	CMOS	External activation of the GPS function.

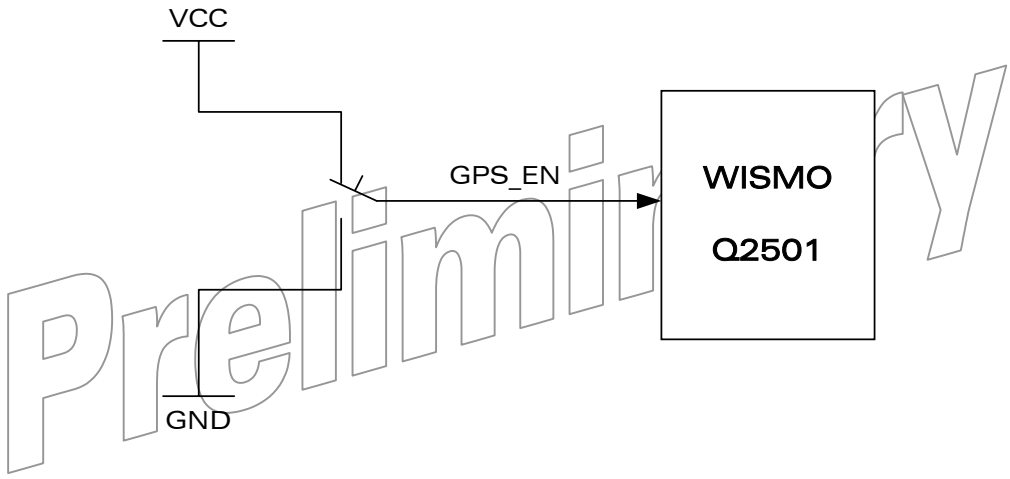


Figure 29: GPS activation function implementation

Hardware activation pin for GPS function is available on the system connector (pin # 21):

- GPS_EN = high logic level: GPS section is enabled,
- GPS_EN = low logic level: GPS section is disabled.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4.2 GPS serial links

3.4.2.1 Main GPS Serial Link implementation (GPS_UART2)

This 2-wire serial interface is a 3 V interface.

In default configuration, this interface allows GPS NMEA frame communications.

Pin Description

Signal	Pin #	I/O	I/O type	Description
GPS_RXD2	1	O	Open Collector with 10 kΩ internal pull-up	CT104- Receive Serial Data
GPS_TXD2	2	I	CMOS 2.8 V	CT103- Transmit Serial Data

Preliminary

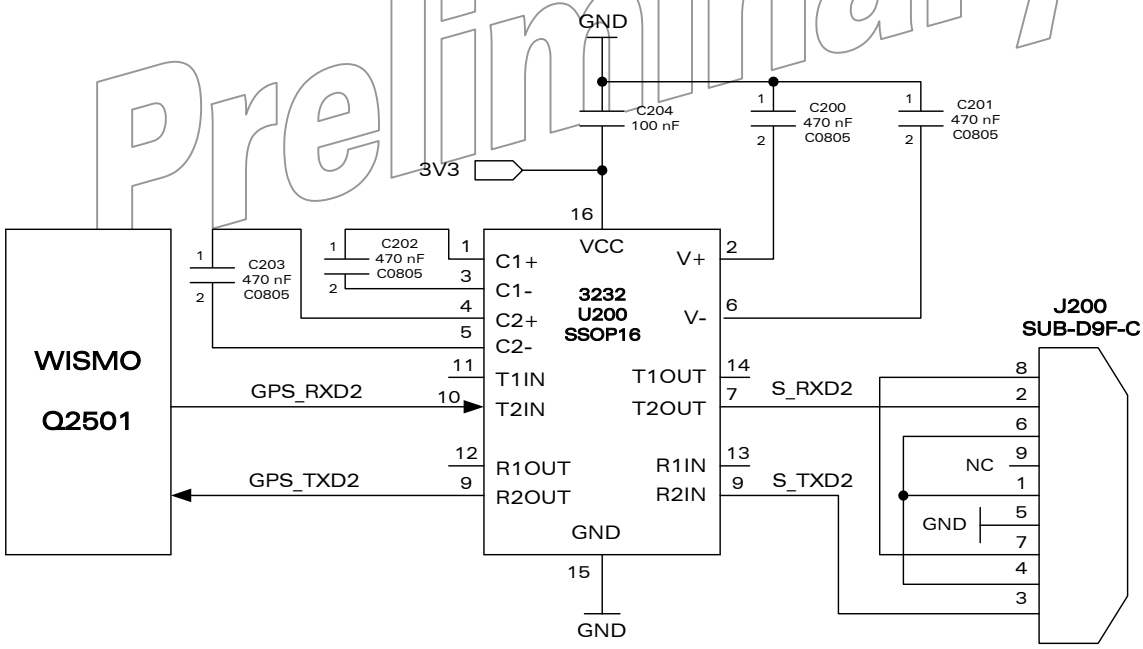


Figure 30: Example of RS232 level shifter implementation for GPS UART2

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4.2.2 Auxiliary GPS Serial Link implementation (GPS_UART0)

This 2-wire serial interface is a 1.8 V interface.

Default protocol on this serial link is RTCM.

However, NMEA protocol can be available on this serial link by software configuration via the GPS Base Band section.

Pin Description

Signal	Pin #	I/O	I/O type	Description
GPS_RXD0	3	O	GPS_1X	CT104- Receive Serial Data
GPS_TXD0	4	I	CMOS 1.8 V	CT103- Transmit Serial Data

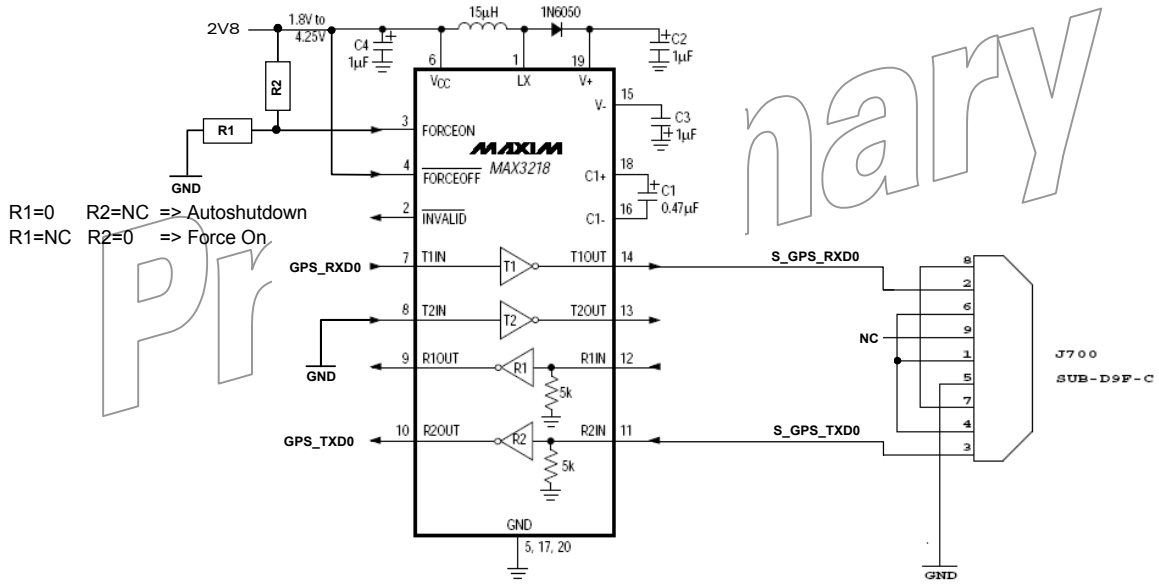


Figure 31: Example of RS232 level shifter implementation for GPS UART0

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4.3 Dead reckoning interface

3.4.3.1 SPI interface for gyroscope and temperature sensors

The WISMO Q2501 module is configured as a SPI master.

The SPI interface consists in five signals as described in the table below.

Pin Description

Signal	Pin #	I/O	I/O type	Description
GPS_SCK	5	I	CMOS 1.8V	SPI Clock
GPS_MOSI	8	I/O	CMOS 1.8V/1X	Serial Data (Master Out/Slave In)
GPS_MISO	11	I/O	CMOS 1.8V/1X	Serial Data (Master In/Slave Out)
GPS_PCS0_N	13	O	CMOS 1.8V/1X	Selects temperature sensor
GPS_PCS1_N	15	O	CMOS 1.8V/1X	Select A/D converter for Gyroscope signal

Preliminary

The figure hereafter gives the block diagram of the GPS SPI interface connected to:

- A/D converter for gyroscope sensor,
- Temperature sensor.

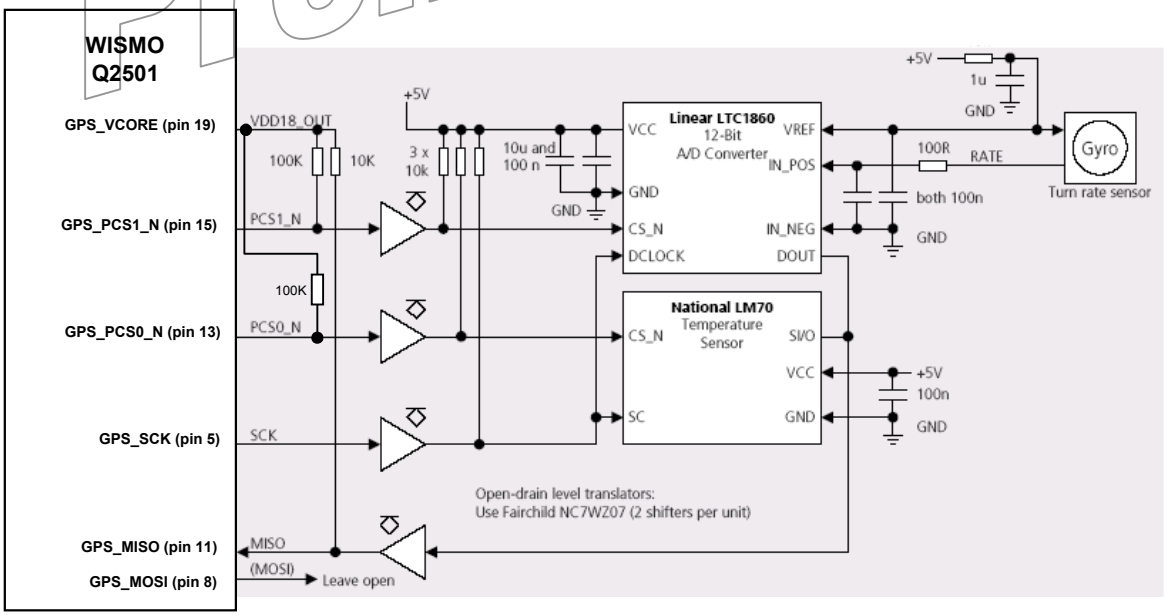


Figure 32: SPI interface implementation for the dead reckoning function

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

Note that a 1.8 V/ 5 V voltage level adaptation is implemented between the WISMO Q2501 signals and the sensor devices (A/D converter and temperature sensor). Voltage level adaptation is implemented using open-drain buffers and pull-up resistors connected to the open-drain outputs.

The 100 kΩ resistor connected between PCS1_N signal and VDD18_OUT is required to keep PCS1_N high (inactive) during power up when PCS1_N is temporarily in high impedance state.

To get better results, it is recommended to filter (low pass filter) a dedicated 5 Volt voltage used to:

- supply the gyroscope,
- provide the reference voltage to the A/D converter (VREF input).

Even smallest voltage drops on the 5 V supply (due to load changes in the WISMO Q2501 module) can have a negative impact on the DR accuracy in case of prolonged outages (i.e. long tunnels).

Appropriate coupling capacitors must be added as well according to the recommendations given in the data sheets of the illustrated semiconductor devices.

All the resistors used will have 5 % accuracy or better. In the same way capacitors (X7R type) will have 10 % accuracy or better.

Notes:

- for correct operation with the GPS EKF (Enhanced Kalman Filters) firmware provided, the diagram given in Figure 32 must be adopted without making any modifications like (but not limited to) using different types of semiconductor devices and changing signal assignment.
- The following gyroscopes have been approved, so do not use any others:
  - MURATA:
    - ENV-05F,
    - ENV-05G,
  - PANASONIC :
    - EWTS82.
- Please follow the design recommendations from gyroscope manufacturers for proper analog signal conditioning.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.4.3.2 Reverse Indicator Input

Information not available for preliminary version.

3.4.3.3 Odometer Input

Information not available for preliminary version.

3.4.4 1.8 V Digital Power Supply for External Devices

Information not available for preliminary version.

3.4.5 GPS External Interruption

Information not available for preliminary version.

3.4.6 GPS Antenna Power Supply

Information not available for preliminary version.

Preliminary

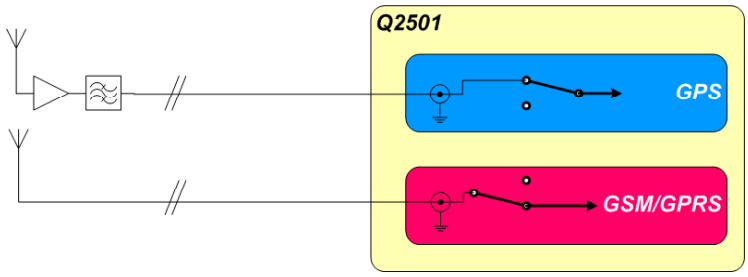
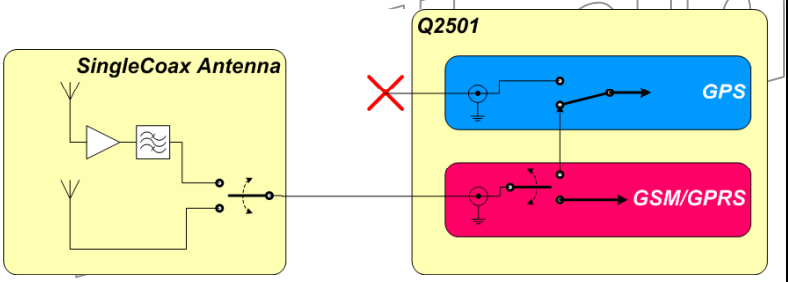
This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.5 RF part

3.5.1 Antenna connection possibilities

The GSM/GPRS & GPS antennas can be connected to the module in two different ways:

Connection Block diagram	Description
	<u>Normal connection</u> Two dedicated antennas are used
	<u>Single Coax connection</u> One specific antenna is used, connected to the GSM/GPRS connector.

The Single Coax feature allows to save a coaxial feeder. Obviously, a specific antenna is used.

☞ For more information about Single Coax Antenna, please contact WAVECOM Support.

<u>Notes</u>:

- The WISMO Quik Q2501 module does not include any antenna switch for a car kit but this function can be implemented externally and it can be driven using a GPIO.
- The antenna cable and connector should be chosen in order to minimize losses in the frequency bands used for E-GSM 900 MHz and DCS 1800 MHz.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

- 0.5 dB can be considered as a maximum value for loss between the module and an external connector.

3.5.2 GSM/GPRS antenna connection

3.5.2.1 Antenna specifications

The GSM/GPRS antenna must fulfil the requirements given in the table hereafter.

A dual-Band antenna will work in these frequency bands and must have the following characteristics:

Characteristics	E-GSM 900	DCS 1800
Frequency TX	880 to 915 MHz	1710 to 1785 MHz
Frequency RX	925 to 960 MHz	1805 to 1880 MHz
Impedance	50 Ohms	
VSWR Rx max	1.5 : 1	
VSWR Tx max	1.5 : 1	
Polarization	Linear	
Typical radiated gain	0 dBi in one direction at least	

Preliminary

Note:

- WAVECOM recommends a VSWR max. of 1.5:1 for the Rx and Tx. Nevertheless, all aspects of this specification will be fulfilled even with a VSWR max. of 2:1 for the Rx and the Tx.

- the DC impedance presented by the GSM/GPRS connection is floating. Nevertheless, there is no problem when using antennas that present a short to ground.

GSM antenna providers:

Refer to paragraph 9.6.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.5.2.2 Antenna implementation

The antenna should be isolated as much as possible from the analog & digital circuitry (including the interface signals).

On applications embedding an internal antenna, a poor shielding could dramatically affect the sensitivity of the terminal. Moreover, the power emitted through the antenna could affect the application (TDMA noise for instance).

As a general recommendation, all components or chips operated at high frequencies (microprocessors, memories, DC/DC converter), or other active RF parts shall not be placed too close to the module. In such a case, correct supply and ground decoupling areas shall be designed and validated.

One shall avoid placing components around the RF connection and close to the RF line (between the module and the antenna).

RF lines shall be as short as possible in order to minimize losses.

Preliminary

3.5.3 GPS antenna connection

3.5.3.1 Active antenna specifications

Compared to the GSM antenna, the GPS antenna is **active**, what means it embeds a LNA just after the antenna (ceramic patch) itself in order to have better performance (lower NF).

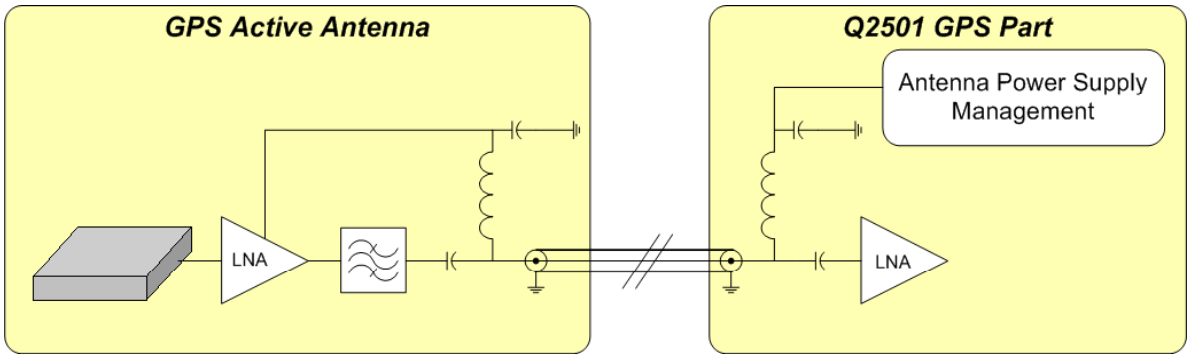


Figure 33: Block diagram of the GPS antenna connection

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

The GPS active antenna must fulfil the following requirements:

Characteristic	GPS			
Frequency RX	L1 = 1575.42			MHz
Impedance	50			ohms
VSWR Rx max	1.5 : 1			/
Polarization	RHCP			/
Antenna gain (including cable losses)	Min. 15	Typ. 25	Max. 45	dB
Typical radiated gain	5 (at zenith)			dBi
Filtering	40 min (@ ± 130 MHz of L1) (rejection of GSM & DCS Tx band.			dB
Supply voltage	3 or 5			V
Supply current	With GPS antenna external supply			
	Min.	Typ. 30	Max. 50	mA
	With GPS antenna internal supply			
	Min.	Typ. 10	Max.	mA

Preliminary

GPS Active antenna providers:

Refer to paragraph 9.7.

3.5.3.2 Active antenna implementation

Antenna implementation is more critical than GSM, since it directly impacts:

- the received signal strength (far more lower than GSM),
- the number of satellites seen by the receiver (the positioning error).

The following rules of thumb should be observed:

- it should be in the same plan as the horizon,
- it should have a full view of the sky,
- the sky view must not be obstructed.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

- even more compared to the GSM antenna, the GPS deals with very low signals. Consequently, the antenna must be placed far from wide band jammers like micro-controllers, RAM, DC-DC Converter.

One main source of GPS jamming is the GSM/GPRS transmission (especially when using DCS1800 band that is only at 135 MHz from GPS signals):

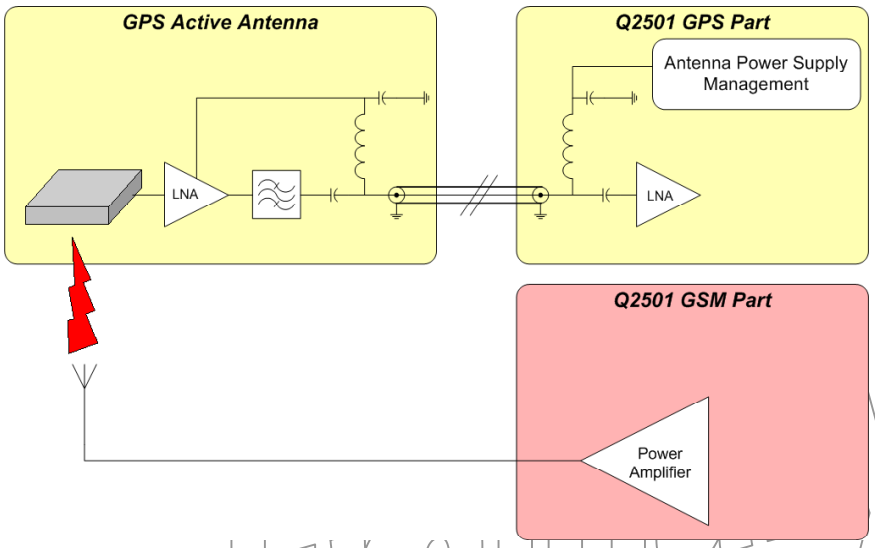


Figure 34: GPS reception jammed by GSM/GPRS transmission

Even if the Q2501 module has been designed to minimize the influence of GSM/GPRS on the GPS performance, user must pay special attention to the GSM & GPS antenna proximity. As a rule of thumb, the level "seen" by the GPS antenna must not exceed –10 dBm.

Practically speaking, it is advised to have a minimum distance of 1 meter between GPS & GSM antennas.

If Combo antenna is used (GSM & DCS antennas are gathered in the same mechanic), the GPS part must use notch filters prior the LNA in order not to saturate it. This point has to be discussed with the antenna designer.

Fortunately, once the GPS is synchronized (it has performed a location), it is robust against jamming.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

3.5.3.3 Passive Antenna implementation

It is not advised to use a passive antenna because:

- If there is some cable length between the GPS ceramic patch and the Q2501 module, those losses will not be hidden (no LNA), so the GPS signal will be lowered, resulting in poor performances.
- Even if there is few cable length (< 5 cm), the Noise Factor at the GPS input connector is the 3 dB Range. The connection between the Q2501 module and the passive antenna could easily add 1 dB (taking into account losses in the cable and the connectors, mismatch losses). Consequently the total NF would be degraded to 4 dB Range. Compared to active antennas, which have typically 1.1 dB NF, there is a 3 dB losses, that will degrade GPS performances.
- The Q2501 module, even shielded, will radiate wideband spectrum (mostly through the system connector). Even if it complies with EMC regulations, this noise may degrade the GPS performances.

3.5.3.4 Active Antenna design

Because active antennas are now quite available "on the shelf", there is no great interest to build its own active antenna.

Nevertheless, if one wants to design an integrated application (like PDA, localization tools) that embeds the Q2501 module and a GPS antenna, the schematic given in Figure 35 is proposed.

preliminary

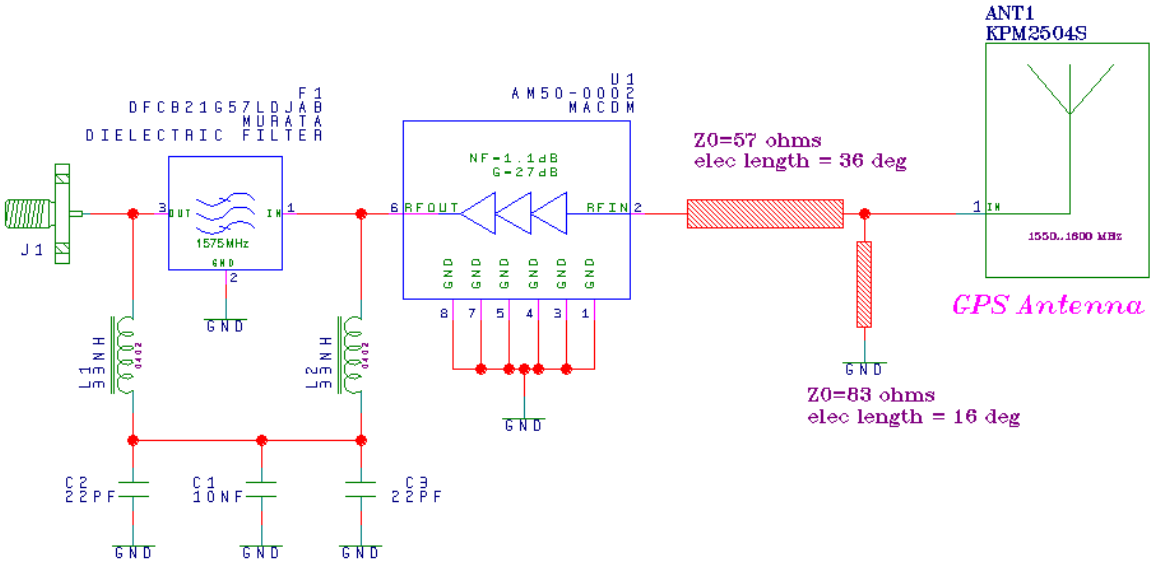


Figure 35: Example of Q2501 module and GPS antenna integrated application

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

The LNA used (AM50-0002 from MACOM) is traditionally used in many GPS active antennas. This LNA is very simple to use, but the consumption is fairly high (20 mA), that is not well suited for handheld devices.

Similar LNA (with lower consumption) from other manufacturers can be used (NEC, Maxim, RFMD...).

Some basic RF rules must be observed for the PCB layout:

- the distance between the ceramic patch antenna and the LNA must be as short as possible in order to minimize losses,
- A large ground plane is recommended for the ceramic patch antenna (typically 25 to 50 cm^2),
- Avoid other components on the antenna side.

☞ If you want to design an active antenna on your application, please contact WAVECOM Support in order to organize a complete design review.

3.5.4 Single coax connection

☞ If you want to design a single coax connection on your application, please contact WAVECOM Support in order to organize a complete design review.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

4 PCB Design

4.1 General Rules and Constraints

On the application board, it is strongly recommended to avoid routing any signals under the module.

Clock and other high frequency digital signals (e.g. serial buses) should be routed as far as possible from the WISMO analog signals.

If the application design makes it possible, all analog signals should be separated from digital signals by a Ground line on the PCB.

4.2 Specific Routing Constraints

4.2.1 System Connector

- Refer to the datasheet of the 80-pin receptacle (from MOLEX) given in paragraph 10.1.
- More detailed information is also available at the following internet address: http://www.molex.com.

4.2.2 Power Supply

4.2.2.1 Routing constraints

- Since the maximum peak current can reach 2 A, WAVECOM strongly recommends a large width for the layout of the power supply signal (to avoid voltage loss between the external power supply and the module supply).
- Pins 75, 77, 78, 79 and 80 should be gathered in a same piece of copper, as shown in the figure hereafter.

Preliminary

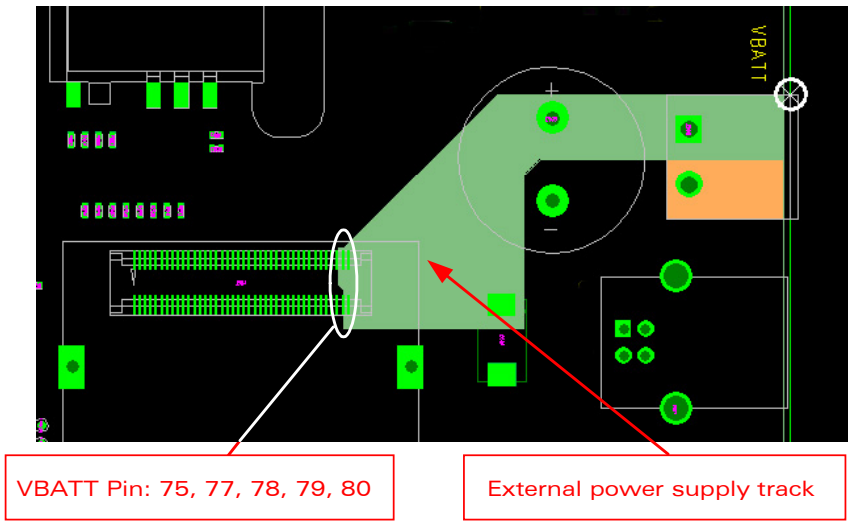


Figure 36 :Example of power supply routing

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

- Filtering capacitors, near the module power supply, could also be added.
- Attention shall be paid to the ground track or the ground plane on the application board for the power supply which supplies the module. The ground track or the ground plane on the application board must support current peaks as for the VBATT track.
- If the ground track between the module and the power supply, is a ground plane, it must not be parceled out.
- The routing must be done in such a way that the total line impedance must be ≤ 10 mΩ @ 217 Hz. This impedance must include the via impedances.
- Same care shall be taken when routing the ground supply.

If these design rules are not followed, phase error (peak) and power loss could occur.

In order to test the supply tracks, a burst simulation circuit is given hereafter. This circuit simulates burst emissions, equivalent to bursts generated when transmitting at full power.

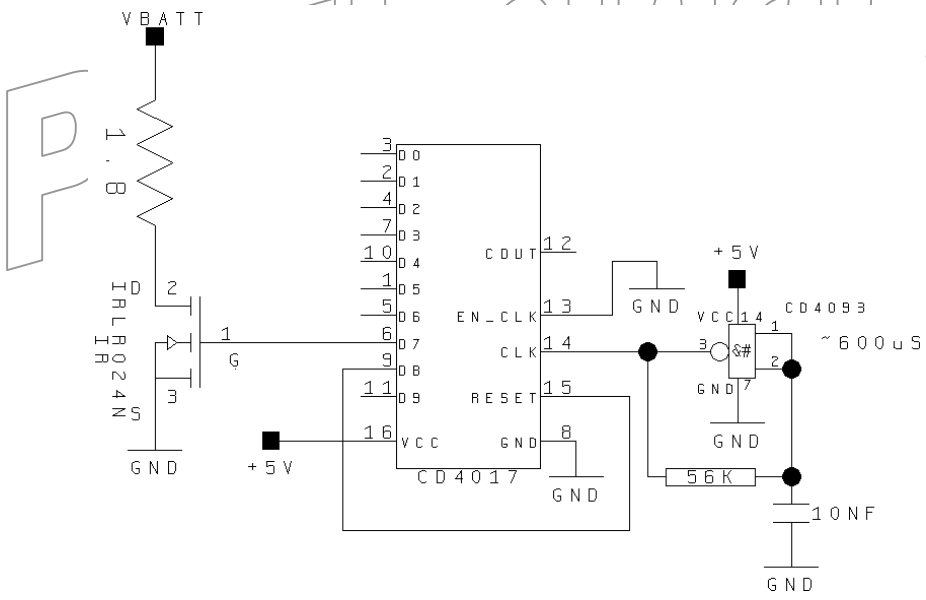


Figure 37: Burst simulation circuit

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

4.2.2.2 Application Ground Plane and Shielding connection

The WISMO Quik Q2501 module shielding case is linked to the ground. The ground has to be connected on the mother board through a complete layer on the PCB.

A ground plane must be available on the application board to provide efficient connection to the module shielding:

- The bottom side shielding of the WISMO module is achieved through the top cold rolled steel cover connected to the internal ground plane of the module. This one is connected through the shielding to the application ground plane.

Best shielding performance will be achieved if the application ground plane is a complete layer of the application PCB:

- To ensure a good shielding of the module, a complete ground plane layer on the application board must be available, with no trade-off. Connections between other ground planes shall be done with vias.

Without this ground plane, external Tx spurious or Rx blockings could appear.

4.2.3 SIM interface routing constraints

- For the SIM interface, length of the tracks between the WISMO module and the SIM socket should be as short as possible. Maximum length recommended is 10 cm.
- ESD protection is mandatory on the SIM lines if access from outside of the SIM socket is possible.
- The capacitor on SIM_VCC signal (100 nF) must be placed as close as possible to the DALC208SC6 component on the PCB (refer to paragraph 3.3.4).

Preliminary

4.2.4 Audio circuit routing constraints

To get better acoustic performances, basic recommendations are the followings:

- The speaker lines (SPKxx) must be routed in parallel, without any wire in between.
- The microphone lines (MICxx) must be routed in parallel, without any wire in between.

All the filtering components (RLC) must be placed as close as possible to the associated MICxx and SPKxx pins.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

4.2.5 RF circuit routing constraints

4.2.5.1 General recommendations

If RF signals need to be routed on the application board, the following recommendations must be observed for the PCB layout:

- The RF signals must be routed using traces with 50 Ω characteristic impedance.

  Basically, the characteristic impedance depends on: the dielectric, the width of the trace and the height between the ground plane.

  In order to respect this constraint, WAVECOM recommends to use MicroStrip or StripLine structure and compute the Trace width with a simulation tool (like AppCad shown in the Figure below and that is available free of charge at the following internet address: http://www.agilent.com).

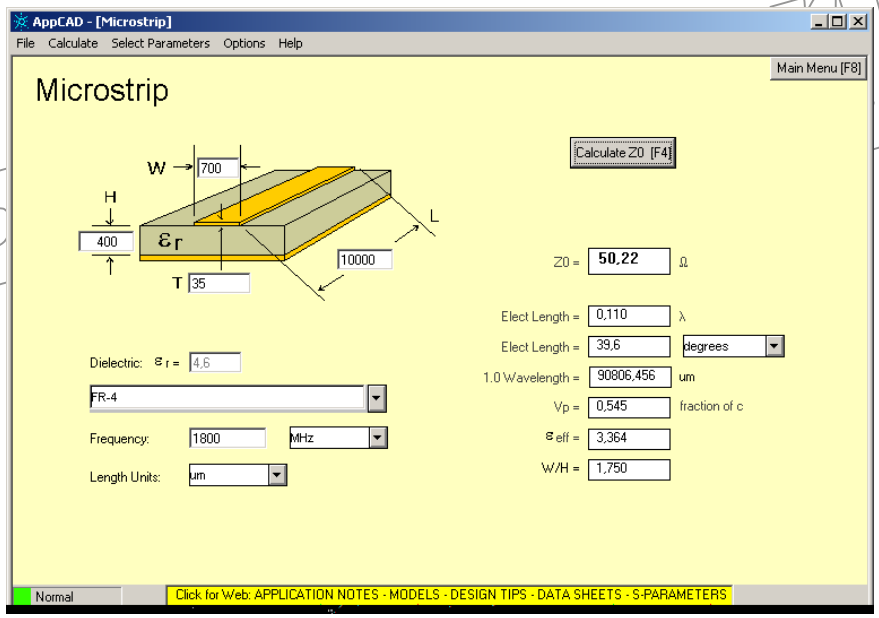


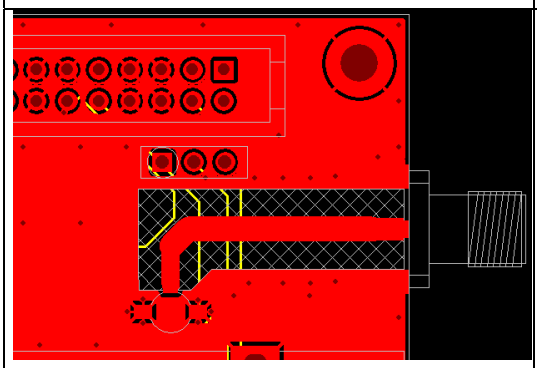
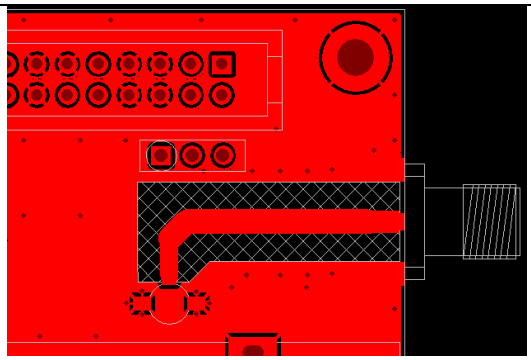
Figure 38: AppCad Screenshot for MicroStrip design

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

- If multi-layer PCB is used, the RF path on the board **must not cross** any signals (digital, analog or supply).

  If necessary, use StripLine structure and route the digital line(s) "outside" the RF structure as shown in the figure below:

Bad routing	Correct Routing
	
The yellow traces cross the RF trace.	There is no signal around the RF path.

- Stripline and Coplanar design require to have a correct ground plane at both sides. Consequently, it is necessary to add some vias along the RF path.
- It is recommended to use **Stripline design** if the RF path is fairly long (**more than 3 cm**), since MicroStrip design is not shielded.

  Consequently, the RF signal (when transmitting) may interfere with neighboring electronics (AF amplifier...). In the same way, the neighboring electronics (micro-controller) may degrade the reception performances.

Preliminary

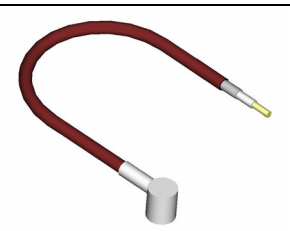
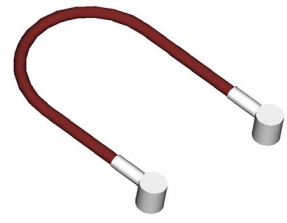
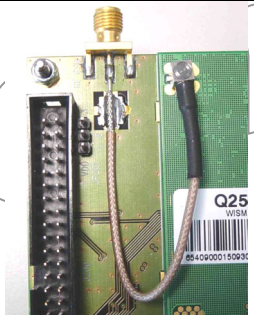
This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

4.2.5.2 Connection possibilities

If the GSM/GPRS or GPS RF connections need to be implemented on the application board (for mechanical purposes for instance), there are two main connection possibilities:

- Connection using a soldered pigtail connection,
- Connection using a dedicated cable assembly.

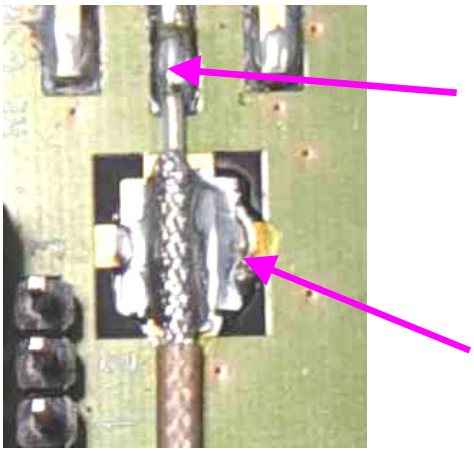
	Soldered Pigtail Connection	Dedicated cable assembly
Cable used		
Description	One side of the coaxial cable is fitted with a male MMS connector, the other one is soldered directly on the application board.	A specific cable is used to make the connection between the module and the customer board (MMS in this example, but other connectors can be used)
Picture example	 *This is the default connection that is used for the WAVECOM Starter Kit.*	
Benefits	▪ cable cheaper ▪ mechanically stronger	▪ affordable for high volumes
Drawbacks	▪ manual soldering needed	▪ two connectors needed per system: a MMS plus a board-to-board. ▪ specific cable (length depends on application). ▪ weaker than soldered pigtail.

☞ in both cases, pay a special attention to the radius curve of the cable assembly, the MMS plug connector must sustain minimal stress in order that it mates correctly.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

If soldered pigtail connection is used on the application board, it is recommended to use the following routing:



Main conductor

- Use 50 Ω traces (StripLine or MicroStrip)

Braid: Ground Connection

- use thermal breaks in order to ease soldering process
- the braid must be soldered over 5 mm long.
  Please solder it as shown in the picture.
- The cable must «go» straight forward, do not stress it (it may break).

Figure 39: Example of PCB routing for pigtail connection

Preliminary

Note: if a 2.5 mm diameter cable is used as pigtail, it is recommended to use cable made with **PTFE insulator type** (Poly-Tetra-Fluoric-Ethylene, also called "Teflon" **like RG316**) instead of PE (Poly-Ethylene, like RG174). Effectively, during the manual soldering process, the PE is subject to melt because of the high temperature.

4.2.5.3 RF circuit for GSM/GPRS function

The GSM/GPRS connector is intended to be directly connected to an antenna. No special electronics is necessary between the two.

4.2.5.4 RF circuit for GPS function

Like the GSM/GPRS connector, the GPS connector is intended to be directly connected to an antenna. As mentioned before, it is strongly recommended to use an active antenna.

For more information, refer to paragraph 3.5.3 GPS antenna connection.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

4.3 Pads design

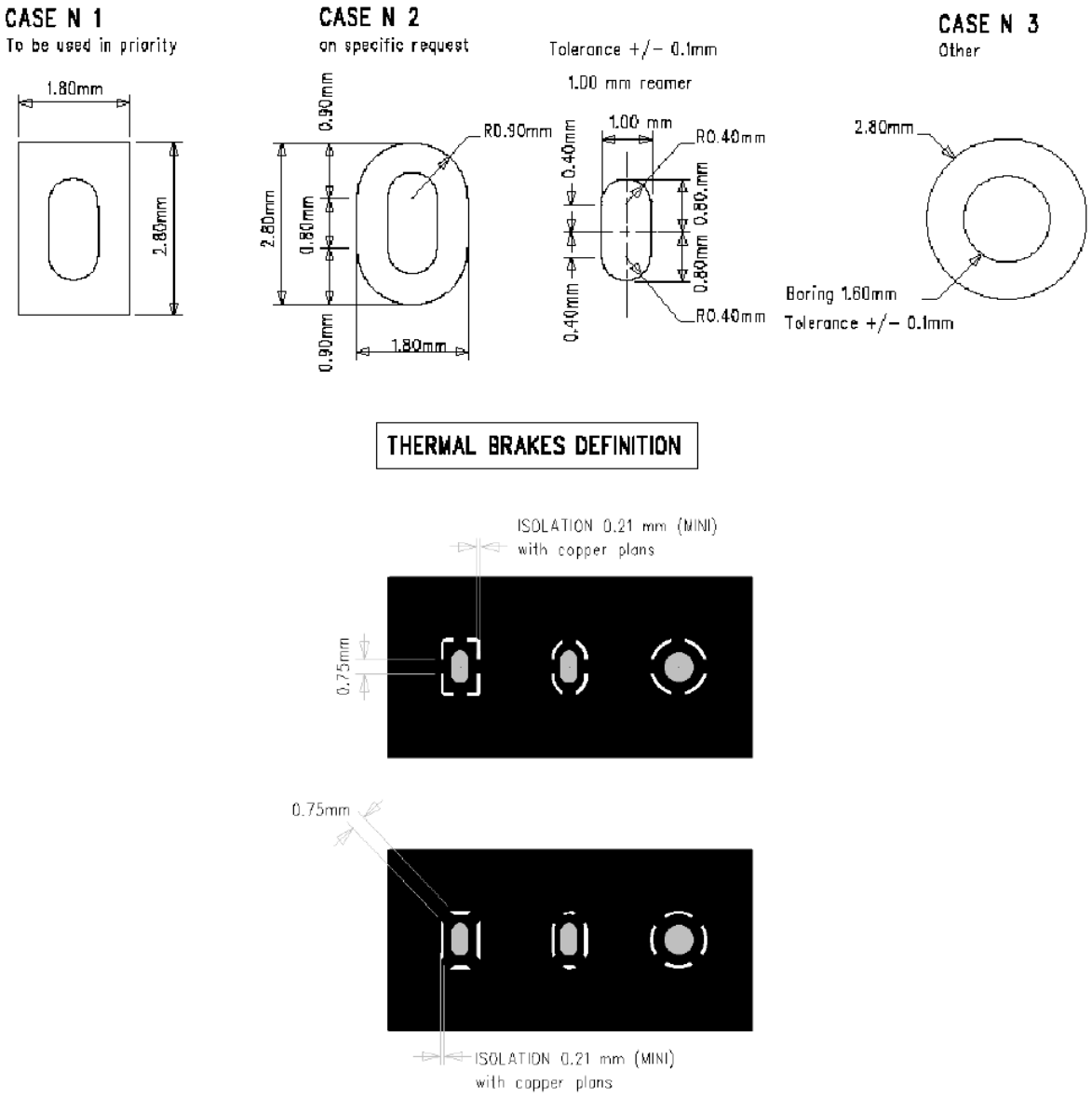


Figure 40: Pads design

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

5 Mechanical Specifications

The next page shows the mechanical drawing which specifies the area needed for module fitting in an application.

That drawing gives, among other things:

- the drill template for the four pads to be soldered on the application board,
- the dimensions and tolerance for correctly placing the 80-pin female connector on the application board.

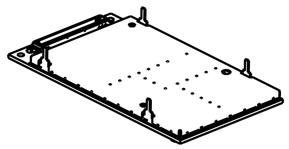
In addition, it is strongly recommended to plan a free area (no components) around the module in order to facilitate the removal/reassembly of the module on the application board.

Preliminary

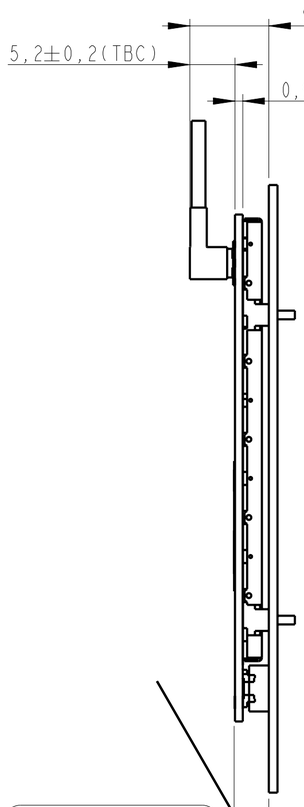
This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

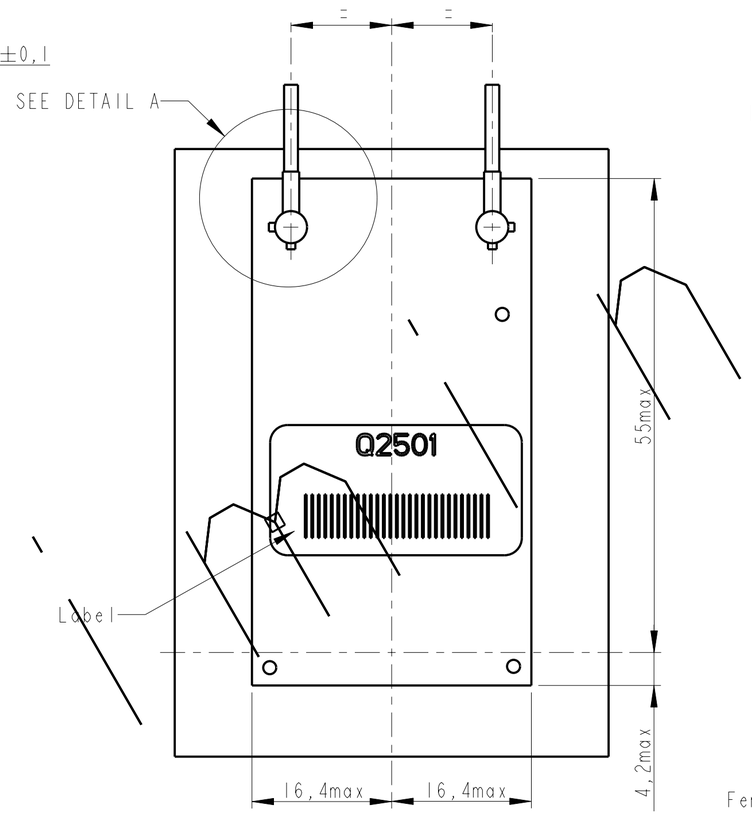
Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

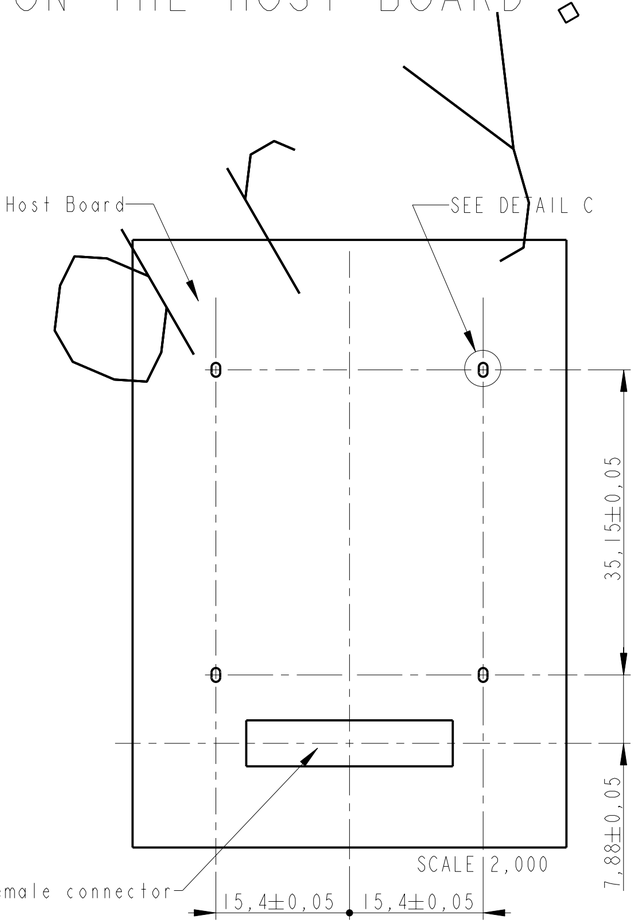
MAXIMUM BULK OCCUPIED ON THE HOST BOARD

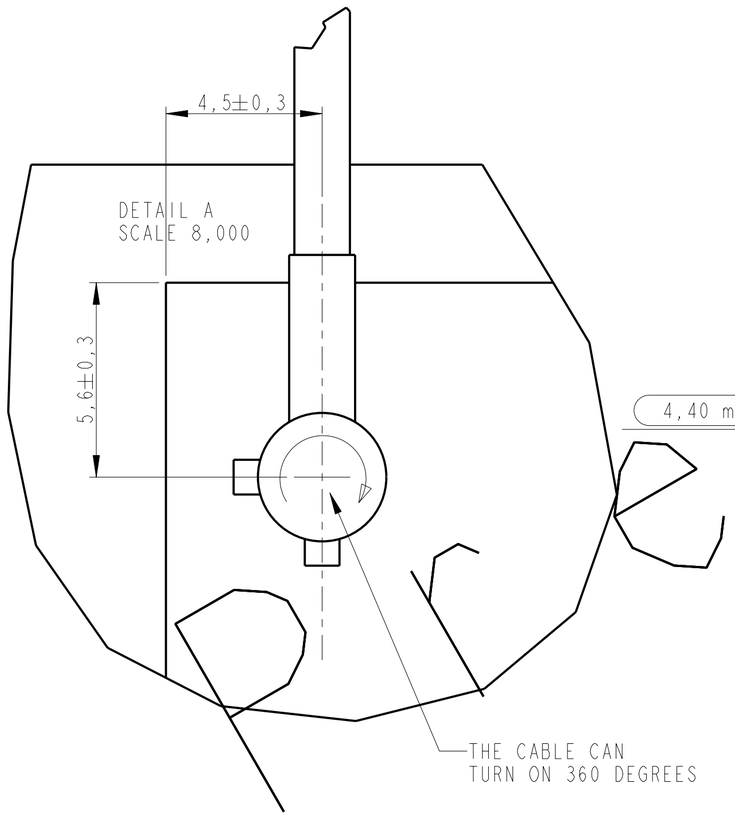


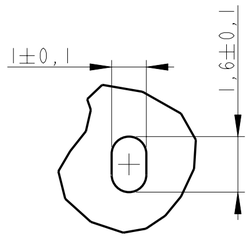
MODULE
SCALE 1,000











DETAIL C
SCALE 8,000

MODIFICATION	DATE	AUTHOR	RESP.	STATUS	IND
Update	12/02/04	JPM	HER	Preliminary	03
Update	16/10/03	JPM	HER	Preliminary	02
Creation	04/09/03	JPM	HER	Preliminary	01

Wismo Quik : Q2501	TOL.GEN.:±0,2	SCALE 2,000	
	FOLIO: 1/1	FORMAT : A2	
MODULE DIMENSIONS	WM-2-02103-V-003-P		
wavecom	AUTEUR : JPM		
	RESPONS : HER		03
PRO/ENGINEER	GPS_ON_MB		IND.

6 EMC and ESD recommendations

The EMC tests have to be performed as soon as possible on the application to detect any possible problem.

When designing, special attention should be paid to:

- Possible spurious emission radiated by the application to the RF receiver in the receiver band
- ESD protection on SIM (if accessible from outside), serial link, etc. Refer to paragraph 3.3.4 SIM interface.
- Length of the SIM interface lines (preferably <10cm)
- EMC protection on audio input/output (filters against 900 MHz emissions), refer to paragraph 3.3.6 audio interface.
- Bias of the Microphone inputs, refer to paragraph 3.3.6.2 audio interface.
- Ground plane : WAVECOM recommends to have a common ground plane for analog / digital / RF grounds.
- Metallic case or plastic casing with conductive paint are recommended

Note:

The module does not include any protection against overvoltage.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

7 Firmware upgrade requirements

The firmware upgrade process consists in downloading a GSM/GPRS software or a GPS software into the corresponding flash memories internal to the WISMO Q2501 module.

For both GSM/GPRS and GPS softwares, the downloading is done through the GSM Main Serial link port (UART1) connected to a PC.

There are two ways for downloading a software into the WISMO Q2501 module:

- normal download mode: use of XMODEM protocol,
- alternative download mode: use of a specific downloading software tool in association with the BOOT pin.

The alternative download mode is used when the normal download mode does not work correctly.

The alternative download procedure is started when the BOOT pin is low while powering ON (or resetting) the module.

Preliminary

Access to the following signals is required to carry out a downloading:

- GSM Main serial link signals:
  - GSM_TXD1,
  - GSM_RXD1,
  - GSM_CTS1,
  - GSM_RTS1,
  - GND,
- BOOT signal (used for alternative download),
- ~RST signal (used for alternative download),
- ON/~OFF signal (used for alternative download).

Consequently, it is very important to plan an easy access to these signals during the hardware design of the application board.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

8 Embedded Testability

8.1 Access to the serial link

Direct access to GSM UART1 serial link is very useful for:

- Testability operations,
- Firmware download.

To allow that access, the following design is recommended:

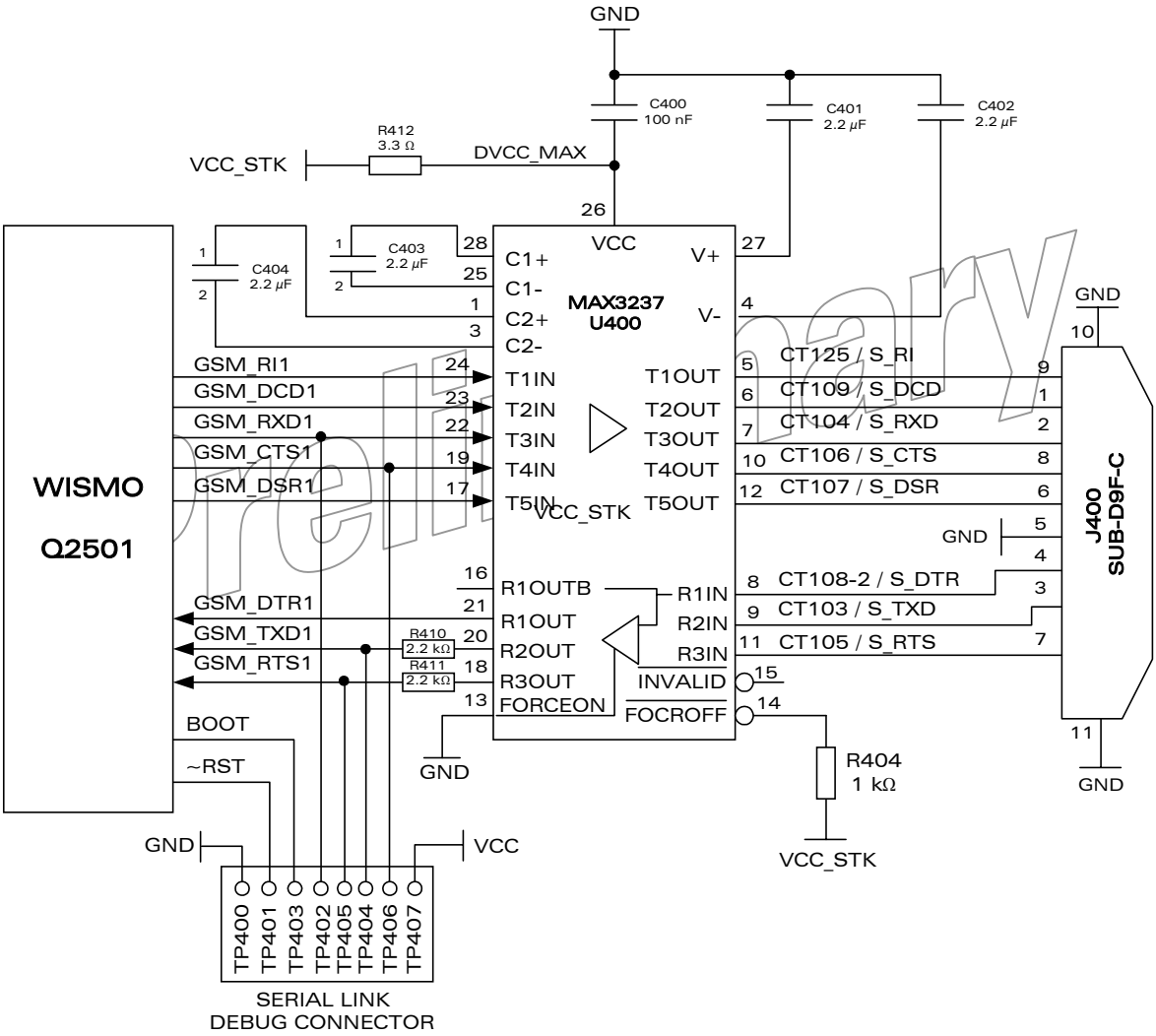


Figure 41: GSM UART1 serial link debug access

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

When it is necessary to download a firmware into the WISMO module without going through the RS232 interface, access to the module is forced via the debug connector. In such a case, input signals coming from this connector mask the input signals coming from the MAX3237 device.

VCC and GND are available on the debug connector to allow the powering of an external RS232 transceiver (such as MAX3237 or MAX3238) in order to, for example, communicate with a PC via a COM port (COM1 or COM2).

Through the debug connector, it is also possible to spy the signals on the serial link.

Note: the presence of both R410 and R411 (2.2 kΩ resistors) does not limit the serial link speed.

An economical solution consists in making the debug connection using 8 Test points (TP) and placing these points to the edge of the application board.

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

8.2 RF output accessibility for diagnostic

During the integration phase of the module, it can be helpful to connect the Q2501 module to a GSM/GPRS simulator in order to check some critical RF Tx parameters.

Even though the module has been certified, some parameters can be degraded because some basic precautions have not been taken (poor power supply for example).

Most of the time, this will not affect the functionality of the product, but the product will not comply with the GSM specifications.

The following parameters can be checked with a GSM/GPRS simulator:

- phase & frequency error,
- output power & GSM burst time template,
- output spectrum (modulation & switching).

Typical GSM/GPRS simulators available are:

- CMU200 from Rhode & Schwarz,
- 8960 from Agilent.

Preliminary

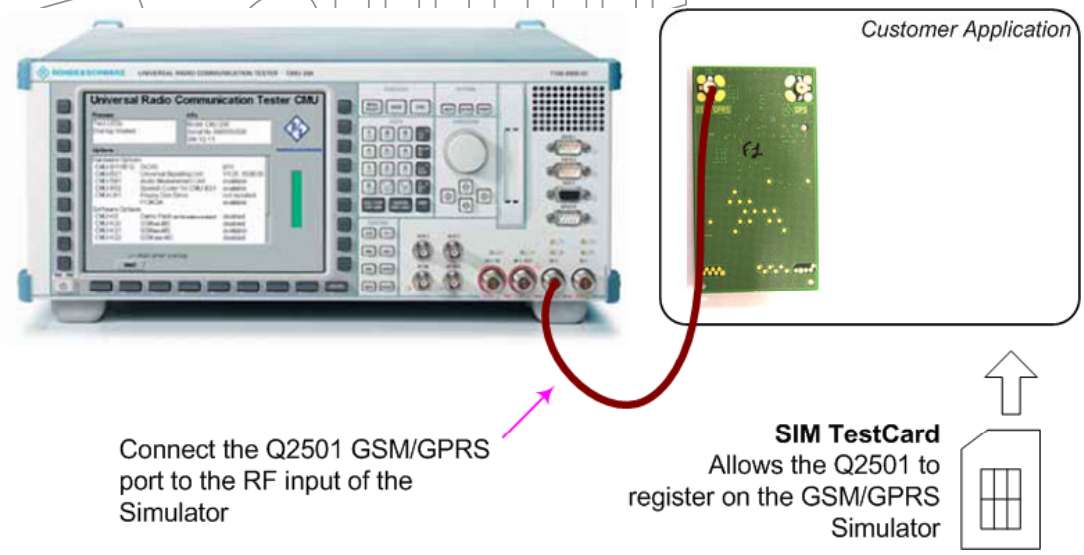

Universal Radio Communication Tester CMU
Customer Application
Connect the Q2501 GSM/GPRS port to the RF input of the Simulator
SIM TestCard
Allows the Q2501 to register on the GSM/GPRS Simulator

Figure 42: Module connection for RF measurements

Because of the high price associated with the GSM/GPRS simulator and the necessary required GSM know-how, the customer can check its application in WAVECOM laboratory.

Please feel free to contact WAVECOM support team.

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

9 Manufacturers and suppliers

This section contains a list of recommended manufacturers or suppliers for the peripheral devices to be used with the WISMO Quik Q2501 module.

9.1 System connector

The system connector is a 80-pin 50 Ω SMT connector with 0.5 mm pitch from MOLEX. For further details about this connector, refer to document [2].

The matting connector from MOLEX has the following part number:

- 52991-0801

For further details about this connector, refer to appendix 10.1.

More information is also available from http://www.molex.com

9.2 SIM Card Reader

- ITT CANNON CCM03 series (see http://www.ittcannon.com)
- AMPHENOL C707 series (see http://www.amphenol.com)
- JAE (see http://www.jae.com)

Drawer type:

- MOLEX: (see http://www.molex.com)
  - Connector: MOLEX 99228-0002,
  - Holder: MOLEX 91236-0002.

9.3 Microphone

The microphone selected must comply with the GSM recommendations in terms of frequency response.

A list of possible suppliers is given hereafter:

- HOSIDEN (see http://www.hosiden.co.jp/)
- PANASONIC (see http://www.panasonic.com/industrial/components/)

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

9.4 Speaker

The speaker selected must comply with the GSM recommendations in terms of frequency response.

A list of possible suppliers is given hereafter:

- SANYO (see http://www.sanyo.com/industrial/components/)
- HOSIDEN (see http://www.hosiden.co.jp/)
- PRIMO (see http://www.primo.com.sg/)
- PHILIPS (see http://www.semiconductors.philips.com/)

9.5 RF cable

A wide variety of cables fitted with MMS connectors is proposed by RADIALL (refer to the MMS datasheet in document [2]):

- MMS pigtails,
- MMS cable assemblies,
- Between series cable assemblies.

More information is also available from http://www.radiall.com/).

Preliminary

9.6 GSM antenna

Provider	Reference	Adress	Contact
Mat Equipement	MA112VX00	Z.I. La Boitardière Chemin du Roy 37400 Amboise FRANCE	Laurent.LeClainche@matequipement.com Tel: +33 2 47 30 69 70 Fax: +33 2 47 57 35 06
ProComm	MU 901/1801/UMTS -MMS + 2M FME	Europarc 121, Chemin des Bassins F-94035 CRETEIL CEDEX	Tel: +33 1 49 80 32 00 Fax: +33 1 49 80 12 54 procom@procom.fr

GSM antennas and support for antenna adaptation can also be obtained from other manufacturers such as:

- ALLGON (see http://www.allgon.com)
- MOTECO (see http://www.moteco.com)
- GALTRONICS (see http://www.galtronics.com)

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

9.7 GPS antenna

Provider	Reference	Type	Adress	Contact
uBlox UK	ANN-ST-0-005-0	3V/5V	u-blox Europe Ltd Mobile Barham Court Teston Maidstone Kent ME18 5BZ England	nigel.carter@u-blox.com> Tel: +44 (0) 1622 618628 Fax: +44 (0) 1622 618629
MicroPuissance			Immeuble FEMTO 1, avenue de Norvège ZA de Courtaboeuf BP 79 91943 LES ULIS CEDEX	jm.gourin@micropuissance.fr Tel: +33 1 69 59 22 22 Fax: +33 1 69 07 67 12
ProComm	GPS 100 KT + FME-SMA	5V	Europarc 121, Chemin des Bassins F-94035 CRETEIL CEDEX	Tel: +33 1 49 80 32 00 Fax: +33 1 49 80 12 54 procom@procom.fr
AMC Centurion	MAF95001 MAF95009	3V 5V	P.O. Box 500, SE-184 25 Åkersberga SWEDEN	Tel: +46 8 555 722 00 Fax: +46 8 555 722 10

More detailed information about U-BLOX Active GPS antennas can be obtained at the following internet address: http://www.info@u-blox.com/.

9.8 Buzzer

- SAMBU (see http://www.sambuco.co.kr/)

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

10 Appendix

Preliminary

This document is the sole and exclusive property of WAVECOM. Not to be distributed or divulged without prior written agreement.

Ce document est la propriété exclusive de WAVECOM. Il ne peut être communiqué ou divulgué à des tiers sans son autorisation préalable.

FEATURES AND SPECIFICATIONS

0.50mm (.020") Pitch Board-to-Board Receptacle

52991

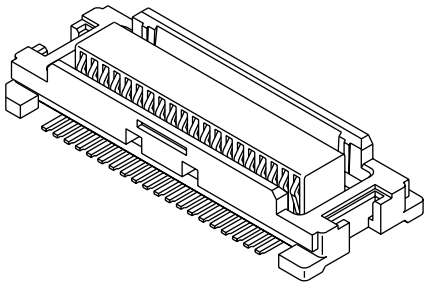
SMT, Dual Row Vertical Stacking

Features and Benefits
- Stacking Heights: 3.0 and 4.0mm
- Sizes 20 to 80 circuits
- Locking feature provides secure mating
- High temperature housing
- Durable blade on beam contact interface
- Anti-flux design

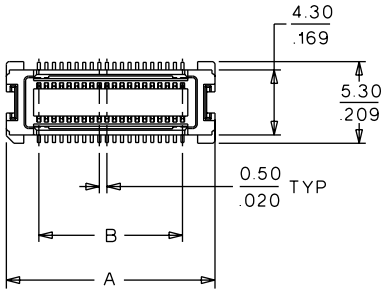
Reference Information
Packaging: Embossed tape
Mates With: 53748 (H=3.0mm)
53916 (H=4.0mm)
Designed In: Millimeters

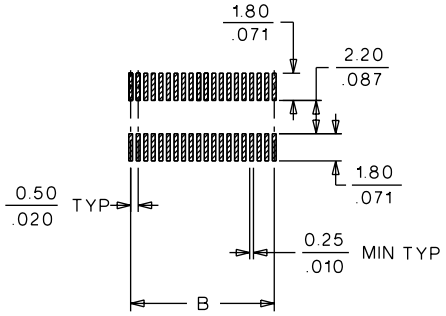
Electrical
Voltage: 50V
Current: 0.5A
Contact Resistance: 50mΩ max.
Dielectric Withstanding Voltage: 500V AC
Insulation Resistance: 100 MΩ min.

Physical
Housing: White glass-filled LCP plastic, UL 94V-0
Contact: Phosphor Bronze
Plating: Gold over Nickel
Operating Temperature: -40 to +105°C

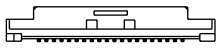


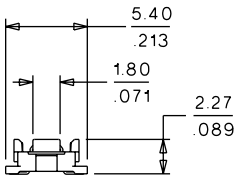
CATALOG DRAWING (FOR REFERENCE ONLY)





PCB LAYOUT: COMPONENT SIDE





ORDERING INFORMATION AND DIMENSIONS

Circuits	Order No.	Dimension		Carrier Tape Width
		A	B	
20	52991-0208	8.80 (.346)	4.50 (.177)	16.00 (.630)
30	52991-0308	11.30 (.170)	7.00 (.275)	24.00 (.945)
40	52991-0408	13.80 (.444)	9.50 (.374)	24.00 (.945)
50	52991-0508	16.30 (.641)	12.00 (.472)	32.00 (1.260)
60	52991-0608	18.80 (.740)	14.50 (.570)	32.00 (1.260)
70	52991-0708	21.30 (.838)	17.00 (.669)	44.00 (1.732)
80	52991-0808	23.80 (.937)	19.50 (.767)	44.00 (1.732)

Note: Contact Molex for embossed tape specifications
Note: Use only one connector per daughterboard in order to insure proper mating alignment